From:	Ruyle, Jennifer -FS
To:	Jessop, Carter
Cc:	Goldmann, Elizabeth
Subject:	RE: Attendees for Rosemont Meeting
Date:	Thursday, June 12, 2014 4:44:55 PM

Thanks Carter, and thanks for participating at such short notice.

From: Jessop, Carter [mailto:JESSOP.CARTER@EPA.GOV]
Sent: Thursday, June 12, 2014 3:30 PM
To: Ruyle, Jennifer -FS
Cc: Goldmann, Elizabeth
Subject: Attendees for Rosemont Meeting

Hello Jennifer,
Elizabeth Goldmann just asked me to send you this message because she's having computer problems. She asked me to give you the attendee list for the meeting with Rosemont that followed yesterday's hydrology working group meeting. She mentioned that she may have erroneously informed you that Kathy Goforth participated in the meeting rather than Kathleen Johnson for EPA. The participants that I was able to catch the names of include:

Rosemont: Kathy Arnold, Rod Pace, Jamie Sturgess,
USFWS: Jean Calhoun, Jason Douglas, Steve Spengle (by phone),
Corps: Marjorie Blaine,
USFS: Jim Upchurch, +2 others?
BLM: Tim Shannon, Karen ?,
SWCA: Chris Garrett,
EPA: Jason Brush, Kathleen Johnson, Jane Diamond, Carter Jessop

Thank you.

-Carter

Carter W. Jessop
U.S. EPA, Region 9
Environmental Review Section (ENF-4-2)
75 Hawthorne Street
San Francisco, CA 94105
(415) 972-3815
jessop.carter@epa.gov

penalties. If you believe you have received this message in error, please notify the sender and delete the email immediately.

From: Ruyle, Jennifer -FS
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; Stamer, Marc -FS; cgarrett@swca.com; mpolm@swca.com; [redacted]; abarclay@swca.com; Calhoun, Jean; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Kathy Arnold; blindenlaub@westlandresources.com; David Cerasale; Joyce M. Francis; Raul Vega; JWindes@azgfd.gov; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; julia.fonseca@pima.gov; brian.powell@pima.gov; blomeli@blm.gov
Subject: RE: Rosemont Copper Project Hydrology Workshop
Date: Monday, June 09, 2014 3:59:56 PM

Greetings working group, as of Monday morning, the following documents and information are in the client access folder:

- The new BLM data received by the Forest Service post-FEIS, and a memo summarizing that data (uploaded Friday)
- Correspondence submitted by EPA re: the 401 certification (uploaded Friday)
- Report from Rosemont discussing FEIS streamflow analysis, and alternative approach (uploaded Saturday)
- SWCA sensitivity analysis for the FEIS streamflow analysis (uploaded Friday)
- Additional documents from SWCA that might be useful during discussion (several graphics, a history of the project water resources work, and a brief mathematical look at stream/aquifer relationship) (uploaded Monday)

Look forward to seeing you all tomorrow. Please feel free to call my cell if you have trouble finding to meeting location of if anything else comes up.

Jennifer M. Ruyle
Natural Resources and Planning Staff Officer
Coronado National Forest
300 W. Congress
Tucson, AZ 85701
jruyle@fs.fed.us
O: 520.388.8351
C: [redacted]

From: Ruyle, Jennifer -FS
Sent: Friday, June 06, 2014 5:28 PM
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; Stamer, Marc -FS; 'cgarrett@swca.com'; 'mpolm@swca.com'; '[redacted]'; 'abarclay@swca.com'; Ruyle, Jennifer -FS; 'Calhoun, Jean'; jason_douglas@fws.gov; 'cfsmith@usgs.gov'; Vogel, Mindy S -FS; 'leenhout@usgs.gov'; 'alcoes@usgs.gov'; 'Jessop, Carter'; 'Leidy, Robert'; 'Goldmann, Elizabeth'; 'Jeffrey Simms'; 'Moore, Daniel'; 'Kathy Arnold'; 'blindenlaub@westlandresources.com'; 'David Cerasale'; 'Joyce M. Francis'; 'Raul Vega'; 'JWindes@azgfd.gov'; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; julia.fonseca@pima.gov; 'brian.powell@pima.gov'
Subject: Rosemont Copper Project Hydrology Workshop

Greetings working group, the finalized agenda for Tuesday and Wednesday is attached. The map with the location is posted to the folder.

Information provided is located in a folder here (instructions attached):
https://client.swca.com/- use the following (case-specific)
Login: R(b) (6)
Password:

If anyone has information to submit after you get this email, please create a folder with Agency name, if it's not already there, and upload the documents/data directly to that folder. Also, if you have trouble submitting data, please contact Chris Garrett by email at: cgarrett@swca.com

Instructions for calling in below:

FS Video Participant Instructions:

(b) (6)

Telephone Participant Instructions:

U(b) (6)

If you have any questions, please call my cell phone, listed below. Looking forward to seeing you Tuesday.

Jennifer M. Ruyle
Natural Resources and Planning Staff Officer
Coronado National Forest
300 W. Congress
Tucson, AZ 85701
jruyle@fs.fed.us
O: 520.388.8351
C: 5(b) (6)

From:	Vogel, Mindy S -FS
To:	Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; nparetti@usgs.gov; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov); msdaversa@blm.gov; blomeli@blm.gov; nparetti@usgs.gov; drpool@usgs.gov; Jesse Dickinson (jdickins@usgs.gov)
Subject:	RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting
Date:	Wednesday, July 30, 2014 2:27:15 PM
Attachments:	removed.txt image003.png image004.png Fed_Working_Group_notes_072314.pdf

Hi Team

Attached are the notes (below the agenda) from last week's meeting in addition to the task with follow-up items. Please note, the last page indicates that we are asking for all the additional information to be posted to the client server by August 8th (many of you are already aware of this date).

If you have any questions or concerns, please contact me.
Thanks!!

CNF_email_sign

From: Vogel, Mindy S -FS
Sent: Friday, July 18, 2014 2:30 PM
To: Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; leenhout@usgs.gov; alcoes@usgs.gov; JESSOP.CARTER@EPA.GOV; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov)
Subject: RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

Hi Team.

Attached you will find a number of documents for the upcoming meeting on June 23rd for the

federal agency working group on the Rosemont Copper project. The agenda includes the time, location, and dial in instructions. The purpose for the meeting is described in the agenda as well as below in the original email from the FS to this group.

I am also attaching:

(1) a summary of all the data and information reports that were turned in to the FS since the last meeting in June. Hopefully you have already had a chance to review this information as it was posted to the client share site at [redacted].

(2) Nine (9) briefing papers on different approaches that were presented at the last meeting. These will be discussed briefly by Chris Garrett at the start of the meeting on 7/23.

Please forward this message on only to others in your agency whom I may have missed that will be participating in this meeting.

If you have any questions, please feel free to contact me (info below).
Thanks!!

CNF_email_sign

From: Ruyle, Jennifer -FS
Sent: Friday, June 27, 2014 4:04 PM
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; JESSOP.CARTER@EPA.GOV; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; Ruyle, Jennifer -FS; cgarrett@swca.com; Melissa Polm (mpolm@swca.com)
Cc: Marjorie.E.Blaine@usace.army.mil
Subject: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

As part of the follow-up to the hydrology working group meeting on June 10-11, we would like to meet with the sub-set of Federal agency participants on July 23rd, all day. The purpose of the meeting will be to review and discuss selected possible analysis approaches that could be used in the Section 7 process to describe future impacts to aquatic and riparian systems. The specific goal of the meeting will be to discuss the information presented in a series of draft briefing papers prepared by the Forest Service, in order to identify which approaches would decrease uncertainty or increase accuracy compared to existing analysis. Briefing papers will be distributed prior to the meeting to allow adequate time for review. The meeting location is yet to be determined, but we

will make sure there is video conferencing capabilities for those unable to attend in person. Please let me know if you are able (or not) to attend. Thanks!

Jennifer Ruyle
Natural Resources and Planning Staff Officer

Forest Service
Coronado National Forest, Supervisor's Office

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Caring for the land and serving people

********** ATTACHMENT REMOVED **********

This message contained an attachment which the administrator has caused to be removed.

********** ATTACHMENT REMOVED **********

Attachment name: [image001.jpg]
Attachment type: [image/jpeg]

Rosemont Copper Project
Federal Agency Hydrology/Biology Meeting

July 23, 2014, 9:00 a.m. – 5:00 p.m. PST
National Advanced Fire and Research Institute (NAFRI)
3265 East Universal Way, Tucson AZ

Dial-in Instructions:

Video participants dial: 1(b) (6) [redacted]

Phone participants dial: (b) (6) [redacted]

Purpose of Meeting:

In May 2014, the Coronado National Forest indicated that it would be reinitiating Section 7 consultation on the Rosemont Copper project. A larger working group met on June 10-11, 2014 to discuss new information and possible analysis approaches that could be used for the Supplemental Biological Assessment. On June 13, 2014, the Coronado sent out a request to participating agencies for specific information. Much of this information has now been provided to the FS and shared with this group at *https://client.swca.com/RosemontGWMD*.

The purpose of this meeting is to discuss the new information provided, as well as to discuss a series of possible approaches for predicting future impacts to the aquatic and riparian habitat along Empire Gulch and Cienega Creek. A goal of the meeting will be to develop the list of approaches that are appropriate to use in the Supplemental Biological Assessment.

Agenda:

9:00 – 9:30	Welcome Introductions	Jim Upchurch
9:30 – 11:00	Overview of Available Information Overview of Available Predictive Approaches	Chris Garrett
11:00 – 12:00	Open Discussion of Predictive Approaches	ALL
12:00 – 1:00	Lunch	
1:00 – 3:30	Continuation of Open Discussion of Predictive Approaches	ALL
3:30 – 4:00	Wrap-up, Discussion of Next Steps	Mindy Vogel

List of Attendees:

BLM: Tim Shannon, Dan Moore, Jeff Simms, Mark D'Aversa, Ben Lomeli

EPA: Rob Leidy, Carter Jessop

USGS: Jesse Dickinson, Nick Paretti, Don Pool

USFWS: Jean Calhoun, Jason Douglas

FS: Jim Upchurch, Jennifer Ruyle, Mindy Vogel, Marc Stamer, Salek Shafiqullah

SWCA: Chris Garrett, Melissa Polm, Angela Barclay

Discussion Points / Conclusions:

Prior to the meeting, nine briefing papers were distributed to the group describing possible predictive approaches raised during the meeting on June 10-11, 2014. In addition, a summary of the available information posted by participants since the June 10-11 meeting was provided.

The available information received was summarized and discussed during a presentation led by Chris Garrett. The nine available predictive approaches were also summarized and discussed. The results of this discussion are summarized as follows (note: this is a summary of discussion, no decisions have been made and any approach may be revisited if determined necessary):

Approach	Pros	Cons	Recommendation
Original FEIS Approach (convert modeled drawdown to reduced streamflow using 1:1 linear relationship)	Can be used to describe seasonality Can be used to cross-check predicted streamflow changes May be particularly applicable in marshy areas with standing water Can be applied to both Empire Gulch and Cienega Creek	1:1 linear relationship may not be valid in some hydrologic settings	This approach can be used to cross-check the primary approach. This approach also will allow the full range of impacts (all models, entire range of sensitivity analyses)
Revised FEIS #1 (convert modeled drawdown to reduced streamflow using empirical relationship)	Can be used to describe seasonality Can be used to cross-check predicted streamflow changes	No probabilities involved, but could use peer review to assess reliability or applicability to specific reaches	This approach can be used to cross-check the primary approach. This approach also will allow the full range of impacts (all models,

	Can be applied to both Empire Gulch and Cienega Creek		entire range of sensitivity analyses)
Revised FEIS #2 (use modeled streamflow reductions directly)	Can be used to describe seasonality Can be used to cross-check predicted streamflow changes Can be applied to both Empire Gulch and Cienega Creek	Needs review to assess statistics of correlation	**This is going to be the primary approach—using modeled reduction in streamflow and applying it to existing flow data to predict future flow conditions.**
Lower Cienega Correlations by Pima County and WestLand (covert modeled drawdown to reduced wetted length or streamflow using empirical relationship)	Can be used to cross-check predicted streamflow changes	Needs review to assess statistics of correlation	This approach can be used to cross-check the primary approach. This approach also will allow the full range of impacts (all models, entire range of sensitivity analyses)
Hydro-Logic Interpretation of Upper Empire Gulch springs (affected		Needs peer review, and eventually request for clarification and conversions	This approach requires further analysis to determine whether direct comparison of Empire Gulch Springs to the piezometric head in Test Well No. 2 is reasonable.
WestLand wet/dry probability assessment	Allows look at presence of water instead of presence of flow Statistics allow analysis of “reasonable certainty”	Not applicable reach-by-reach Only applies to Upper Cienega	At this time, this approach does not appear to be useful, both from limited data points (n=8) and from inability to apply reach-by-reach. Could be revisited later for refinement.

EPA Risk Analysis Approach	It wouldn't increase accuracy of any piece of evidence, but would weight relative strength of evidence. Allows for a systematic way to include multiple opinions and multiple lines of evidence	Current process has already accomplished much of what was envisioned by bringing together local expertise and identifying all information available. Long time frame envisioned (6 months).	The approach as presented is fairly generic, and we need more details/examples of how it would be implemented in this specific situation. However, the overall premise may have a role in the process.
Open Channel Modeling	Would allow for a link between reductions in streamflow and characteristics important to fish (depth, width, velocity of flow)	Major outstanding questions: Can the math reflect reality given the overwhelming edge effects? Could you verify with measurements? How fine of a scale could you model? Could it be sensitive for such small measurements? Do species thresholds go down to such small measurements?	At this time, this approach seems to be difficult to implement. However, this approach may have a possible role, depending on the characteristics determined to be important by the biological working group. Needs further investigation.
Fish habitat modeling	Would allow for a link between reductions in streamflow and characteristics important to fish (depth, width, velocity of flow) as well as response by fish species to these variables	Since this modeling is built on open channel modeling, same issues as above	At this time, this approach seems to be difficult to implement. However, this approach may have a possible role, depending on the characteristics determined to be important by the biological working group. Needs further investigation.
Low Flow Analysis	Low Flow analysis is intended to extend	It relies on extrapolation of other	Based on USGS input, seems unlikely to be

	flow records to locations where none exist. This is the case throughout much of the Cienega Creek basin.	existing flow records, but only is feasible if channel and basin properties are similar. It likely wouldn't work very well, as the physical properties near the USGS gauge wouldn't correlate well elsewhere on Cienega Creek or Empire Gulch. May also be undesirable to "doctor" the existing flow records. Using actual flow records for a shorter period may be more defensible.	useful for generating extended base flow data.
USGS Generic Model	Allows a separate theoretical look at the conversion between drawdown and flow	Does not improve accuracy. The results would still be built on top of the existing model. Empirical data now available likely trumps this approach.	Could be applied, but not likely to be an improvement over Refined FEIS Approach #1 for establishing correlation between drawdown and streamflow.

Action Items:

The following information was identified as likely available and important for consideration in the analysis. Please have the following information posted to the client server site (*https://client.swca.com/RosemontGWMD*) by **August 8th**.

BLM: Critical cross-section locations, additional HOBO data, Desert Botanical Garden isotope raw data, additional wet/dry data, Mattie Canyon wet/dry and stream flow data, Piezometer datalogger data, Jeff's maps from field trip, Identification of which wells are pumped.

EPA: Rob Leidy field notes, Risk analysis example (different from Pebble Mine)

USGS: Chris Menges dissertation, 2004 site data

FS / SWCA: Nature Conservancy Habitat reports '04 & '08,

Additionally, the **FS** will take lead and establish and coordinate a federal biological information group (FBIG) to look at: Description of riparian thresholds, Habitat characterization of reaches, and framework/methodology to link changes in hydrology to changes in habitat. Agencies offered names of people determined best fit to participate in this group.

Following additional group discussions, review, and determining the reaches of interest, the **FS** will request report clarifications from Grady (gpm & inconsistencies).

From:	Vogel, Mindy S -FS
To:	Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov)
Subject:	RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting
Date:	Friday, July 18, 2014 2:30:52 PM
Attachments:	image006.png image007.png Agenda_Fed_Working_Group_072314.pdf Summary of All Data Received as of 071814.pdf Briefing Paper - Low Flow Analysis_071714.pdf Briefing Paper - Open Channel_071714.pdf Briefing Paper - USGS Generic Model_071714.pdf Briefing Paper -WetDryProbabilistic_071714.pdf Briefing Paper - EPA Risk Assessment_071714.pdf Briefing Paper - HydroLogic_071714.pdf Briefing Paper - FEISRefined_071714.pdf Briefing Paper - Fish Habitat Modeling_071714.pdf Briefing Paper - LCC Correlations_071714.pdf

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Please forward this message on only to others in your agency whom I may have missed that will be participating in this meeting.

If you have any questions, please feel free to contact me (info below).
Thanks!!

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Sent: Friday, June 27, 2014 4:04 PM
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Cc: Marjorie.E.Blaine@usace.army.mil
Subject: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

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Jennifer Ruyle
Natural Resources and Planning Staff Officer

Forest Service
Coronado National Forest, Supervisor's Office

p: 520-388-8351
c: (b) (6) 2
f: 520-388-8305
jruyle@fs.fed.us

300 West Congress St.
Tucson, AZ 85750
www.fs.fed.us

Caring for the land and serving people

Rosemont Copper Project
Federal Agency Hydrology/Biology Meeting

July 23, 2014, 9:00 a.m. – 5:00 p.m. PST
National Advanced Fire and Research Institute (NAFRI)
3265 East Universal Way, Tucson AZ

Dial-in Instructions:

Video participants dial: 1[redacted]

Phone participants dial: (b) (6) [redacted]

Purpose of Meeting:

In May 2014, the Coronado National Forest indicated that it would be reinitiating Section 7 consultation on the Rosemont Copper project. A larger working group met on June 10-11, 2014 to discuss new information and possible analysis approaches that could be used for the Supplemental Biological Assessment. On June 13, 2014, the Coronado sent out a request to participating agencies for specific information. Much of this information has now been provided to the FS and shared with this group at *https://client.swca.com/RosemontGWMD*.

The purpose of this meeting is to discuss the new information provided, as well as to discuss a series of possible approaches for predicting future impacts to the aquatic and riparian habitat along Empire Gulch and Cienega Creek. A goal of the meeting will be to develop the list of approaches that are appropriate to use in the Supplemental Biological Assessment.

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1:00 – 3:30	Continuation of Open Discussion of Predictive Approaches	ALL
3:30 – 4:00	Wrap-up, Discussion of Next Steps	Mindy Vogel

SUMMARY OF ALL DATA RECEIVED AS OF 7/18/14

= Affected Environment / Baseline = Hydrologic Framework = Possible Approaches

Agency	Information Provided	What?	Where Applicable?	Potential Coding for Use in Analysis
BLM	Aquatic species reintroduction details	Locations and dates for initial stocking, augmentation, and new sites considered, for 5 T&E species.	Throughout Cienega watershed	Affected Environment/Baseline
BLM	Empire Gulch Monitoring Report 2004-2013	Includes counts of 5 T&E species from 2004-2013	Empire Gulch	Affected Environment/Baseline
BLM	Hobo data	Atmospheric temperature data from Jan 2012-July 2012 at 2 locations on Cienega Creek, from Dec 2009-March 2010 on Empire Gulch	Cienega Creek-above bend Cienega Creek-below bend Empire Gulch	Affected Environment/Baseline
BLM	Herp Sightings	Notes on 45 herp observations between 1989 and 2004	LCNCA	Affected Environment/Baseline
BLM	RACE assessment results	RACE assessment results (Excel), for 1988-2004 (4 events).	LCNCA	Affected Environment/Baseline
BLM	Photo points	Photo points for 1989, 1993, 2006	LCNCA	Affected Environment/Baseline
BLM	2008 Bodner-Simms Report	Condition and Trend of Riparian Target Species, Vegetation and Channel Geomorphology	LCNCA	Affected Environment/Baseline
BLM	Riparian Tree Density Data	Riparian tree counts for 1993 and 2006	Cienega Creek	Affected Environment/Baseline
BLM	2007 Bodner, Simms, Gori report	State of the Las Cienegas National Conservation Area: Gila	LCNCA	Affected Environment/Baseline

Agency	Information Provided	What?	Where Applicable?	Potential Coding for Use in Analysis
		Topminnow population status and trends 1989-2005		
BLM	2005 Foster Simms report	Cienega Creek Fish Surveys 2005 – Gila chub status investigation	Cienega Creek	Affected Environment/Baseline
BLM	2013 FROG report	Restoring Leopard Frogs and Habitat in Sky Island Grasslands, includes locations/status	LCNCA	Affected Environment/Baseline
BLM	Wet/dry mapping field notes	CLF, Fish occurrence, 2008, 2009, 2010, 2011, 2013, 2014	LCNCA	Affected Environment/Baseline
BLM	Agave transects	Agave transects for LLNB habitat, 2009, 2011	LCNCA	Affected Environment/Baseline
BLM	SWFL survey data	SWFL survey data for 2006, 2008, 2010, 2011, 2012, 2013, 2014	LCNCA	Affected Environment/Baseline
BLM	WYBCU survey data	Various WYBCU survey data for 2001, 2008, 2009, 2010, 2011, 2014	LCNCA	Affected Environment/Baseline
BLM	Wet/dry survey protocol	Protocol for how to define wet/dry areas (2011)	LCNCA	Affected Environment/Baseline
BLM	Wet/dry mapping	Recent obtained for 2014 Also have for 2006-20131	LCNCA	Affected Environment/Baseline
BLM	Photos of Empire Gulch	Five photos of Empire Gulch from spring 2011.	Empire Gulch	Affected Environment/Baseline
BLM	Empire Gulch Habitat Inventory	Field notes, 6/30/04 (Excel file and PDF). Includes 17 observations of habitat along Empire Gulch as well as depth, width measurements	Empire Gulch but exact locations not known	Affected Environment/Baseline and Hydrologic Framework
BLM	Anamax Files	Well logs, notes, and pumping tests for 2 production wells and 14 test wells from 1970s	Empire Ranch and vicinity	Hydrologic framework
BLM	Desert Botanical Gardens	Singe chart showing oxygen and	Geographic extent is	Hydrologic framework

Agency	Information Provided	What?	Where Applicable?	Potential Coding for Use in Analysis
	isotopes	hydrogen isotopes for streams and cienegas (minimal explanation provided)	unclear	
BLM	Empire Gulch cross-sections	Large number of elevation points along channel	Upper and Lower Cienega Creek	Hydrologic Framework
BLM	Empire Gulch/Cienega Creek streamflow measurements	Streamflow measurements at two locations, through June 2014	Cienega Creek above Gardner Canyon Upper Empire Gulch	Hydrologic framework
BLM	Well locations	Three shapefiles with 55-wells and BLM wells	LCNCA	Hydrologic framework
BLM	Haney 2005 report	Study of water use on LCNCA	LCNCA	Hydrologic framework
BLM	Raingage data	Includes precipitation data for 11 raingages, from November 2012 through April 2013	LCNCA	Hydrologic framework
BLM	Well and Groundwater data	Includes photos of wells, maps, and water levels. The water level database contains data for over 50 wells, with more frequent measurements starting in 2011, but older data for some wells going back to the 1950s. The well photos document 44 wells that appear to overlap the water level database.	LCNCA	Hydrologic framework
BLM	USGS Circular 1376	Barlow and Leake; Streamflow Depletion by Wells—Understanding and Managing the Effects of Groundwater Pumping on Streamflow	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
BLM	Brand et al 2011	Projecting avian response to linked changes in groundwater	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive

Agency	Information Provided	What?	Where Applicable?	Potential Coding for Use in Analysis
		and riparian floodplain vegetation along a dryland river: a scenario analysis		approach
BLM	Cornerstones 2011 Report	Market-based Responses to Arizona's Water Sustainability Challenges	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
BLM	UA 2011 Water Needs Report	Arizona Environmental Water Needs A University of Arizona Water Resources Research Center Project 2011 Assessment Report	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
BLM	USGS Circular 1261	Water Availability for the Western United States—Key Scientific Challenges	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
EPA	ADEQ 401 Certification comment letter	4/14/14 Comment letter from EPA to ADEQ	Davidson Canyon	Hydrologic framework
EPA	6/30/14 Proposal	Proposed approach for collaborative review of ecological risk	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
Pima County	2013 Powell Report	Summarizing water trends on Lower Cienega Creek	Lower Cienega Creek	Hydrologic framework
Pima County	Water Level/Flow Correlation	Statistical correlation for water levels and extent of baseflow in Lower Davidson Canyon	Davidson Canyon	Hydrologic framework
Pima County	ADEQ appendix	Describes methodology for ADEQ sampling on Cienega Creek	Cienega Creek	Hydrologic framework
Pima County	Myers Review of Recent Submittals	Memo 6/25/14	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
Pima County	Pima County Review of Recent Submittals	Report 7/14/14	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach

Agency	Information Provided	What?	Where Applicable?	Potential Coding for Use in Analysis
Rosemont	Water Quality and Isotope Data	Memo 6/27/14 containing summary of all water quality for wells and springs, including isotopes. Includes Upper Empire Gulch springs	Empire Gulch	Hydrologic framework
Rosemont	Wet/Dry Probabilistic Approach	Memo 6/6/14 revised 6/27/14. Contains predictions of impact as well as criticism of FEIS approach. Revisions include statistics as requested by USFWS for 25% reduction in wetted length.	Cienega Creek	Possible predictive approach, component of predictive approach, or critique of predictive approach
Rosemont	Cross-section data	Memo 6/27/14 containing elevation data for 3 cross-sections in Upper and Lower Empire Gulch	Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
Rosemont	Hydro-Logic Empire Gulch modeling output	Memo 6/27/14 containing additional modeling output specific to Empire Gulch. Analysis of Upper Empire Gulch separate from Lower Empire Gulch. Includes raw data.	Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
USGS	StreamStats website	Has basin characteristics for any given watershed; low flow analysis is not yet functional	Cienega Creek Empire Gulch	Hydrologic framework
USGS	Generic modeling files	Modeling files from Stan Leake aimed at discerning a generic relationship between drawdown and streamflow	Cienega Creek Empire Gulch	Possible predictive approach, component of predictive approach, or critique of predictive approach
USGS/BLM	Streamgage data	• CC near Sonoita (09484550) – 2001-present, paper charts from 1993-2001. Also have rating data.	Cienega Creek Barrel Canyon	Hydrologic framework

Agency	Information Provided	What?	Where Applicable?	Potential Coding for Use in Analysis
		• CC near Pantano (09484560) – 1968-1975 • Pantano Wash near Vali (09484600) – 2007-present • Barrel Canyon (09484580) – 2009-present		

BRIEFING PAPER
CONSIDERATION OF LOW FLOW ANALYSIS

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

During this process, several new approaches were proposed in concept. One of these approaches was the use of 3-day or 7-day low flow analysis. The purpose of this paper is to provide a discussion of this possible approach, the uncertainties involved, and the possible applicability for the Supplemental Biological Assessment.

Description of Proposed Approach using Low Flow Analysis

Low flow analysis is a technique that can be used to develop more complete stream records where only partial streamflow records exist or no streamflow records exist. Two methods are commonly used to estimate missing flow records.

The first method is a regression analysis using basin characteristics alone. This rests on the underlying assumption that the groundwater hydrology of all tributary streams in the basin is similar, and that baseflow is primarily a function of contributing area of the watershed. If at least one streamgaging site is present within the basin, then the baseflow of other stream reaches can be extrapolated from that data and from basin characteristics. Note that a similar technique is built into the StreamStats website, but that functionality has not yet been completed for the Cienega Creek watershed.

A second method relies instead on taking new baseflow measurements in the field at an ungaged site, and then correlating those baseflow measurements with baseflow measurements from a streamgaging site in the same watershed[1].

Purpose of Low Flow Analysis

The purpose of the conducting a low-flow analysis would be to obtain a longer record of streamflow values on Empire Gulch, or develop a record on other tributaries such as Gardner Canyon. By itself this longer flow record is not predictive, but it could be used with other analysis (such as the refined FEIS approach) that use a stream hydrograph.

[1] See for example USGS. 1985. Low-Flow Frequency Estimation Using Base-Flow Measurements. Open File Report 85-95.

Logistics for Completing (time, effort)

Time and effort unknown. The USGS has expertise in this area, but the methodology is well defined and could be conducted by any other party as well.

For Empire Gulch, some baseflow measurements exist already and it may be possible to correlate these to the USGS streamgage on Cienega Creek.

For Gardner Canyon, no baseflow measurements exist and these would need to be collected in the field.

Potential to Reduce Uncertainty or Increase Accuracy

UNCERTAINTY DISCUSSION

1. This approach makes the assumption that the underlying hydrologic framework for Empire Gulch (or Gardner Canyon) is the same as that for the Upper Cienega Creek streamgage.
2. This approach does not provide any prediction of impacts by itself. It would only be an interim step to extend the streamflow record on Empire Gulch or Gardner Canyon prior to assessing impacts from the mine.
3. At a fundamental level, the proposed approach would still rely on changes predicted by the groundwater model, albeit predicted streamflow changes instead of predicted drawdown. The groundwater model has uncertainties associated with the long time frames, long distances, and small drawdowns involved. The fundamental uncertainties associated with the groundwater modeling would not be reduced.
4. At a fundamental level, the actual hydrologic connection of Empire Gulch with the regional aquifer is not understood; the proposed approach would not reduce this uncertainty.

PROFESSIONAL INTERPRETATIONS

This approach could be useful to extend the Empire Gulch streamflow record, since a reasonable period of baseflow measurements already exist. The extension, however, would be a statistical construct and would not be as reliable as the actual field measurements.

Modifying the stream record in this way would be an approach that potentially biases the Empire Gulch data. By definition, the hydrograph would be influenced by the Upper Cienega Creek streamgage and it is recognized that the Upper Cienega Creek streamgage is located in a relatively consistent reach of the creek. This could mask the actual streamflow record of Empire Gulch and moderate any potential impacts. However, using a modified stream record would not preclude also analyzing the original unmodified stream record on Empire Gulch.

BRIEFING PAPER
CONSIDERATION OF OPEN CHANNEL MODELING

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

During this process, several new approaches were proposed in concept. One of these approaches is the use of open channel modeling to better depict depth or flow changes in Empire Gulch. The purpose of this paper is to provide a discussion of this possible approach, the uncertainties involved, and the possible applicability for the Supplemental Biological Assessment.

Description of Open Channel Modeling

Cooperating agencies have suggested a proposed approach that would take a given streamflow in Empire Gulch, model the behavior of that streamflow using an open-channel model such as HEC-RAS or FLO2D, and predict the depth and width of water that would be present in Empire Gulch for that given streamflow.

Purpose of Potential New Analysis

The purpose of conducting open channel modeling would be to provide the connection between modeled flow in Empire Gulch (from the groundwater models) and depth of water and width of water in the stream channel. Depth and width of water is of interest for assessing impacts to species.

Note that this analysis would not provide any prediction of streamflow changes. The open-channel modeling is only a way to translate the amount of streamflow into how deep and wide the flow would be in the channel.

Logistics for Completing (time, effort)

In order to complete this approach, the following steps would be needed:

1. Detailed geometry of Empire Gulch. This can be as simple as a series of surveyed cross-sections (three sections have already been collected by WestLand), or as complicated as LiDAR measurements. (Time estimate: 1 week).
2. Roughness coefficient of stream would need to be estimated, probably based on both literature and visual observations. (Time estimate: 1 week).
3. Predicted streamflow in Empire Gulch from groundwater model is needed. This has now been provided by Rosemont.

4. The open channel flow model would have to be run. Both Pima County and USGS suggested they have the ability to do this. (Time estimate: 1 month).

Potential to Reduce Uncertainty or Increase Accuracy

FUNDAMENTAL HYDROLOGY ASSUMPTIONS

Open-channel modeling is not meant to recreate the complex hydrologic interactions that occur in a stream channel between surface water and groundwater. Open-channel modeling is only designed to route a given amount of water through the channel and assess how that flow changes in response to the geometry of the channel. As such, the proposed approach assumes basically assumes that the stream channel is fed by a point source and that no losses occur in the channel. More sophisticated surface water models can take into account stream losses (i.e., reductions in flow) due to infiltration, but would require knowledge of the permeability of the stream bed material.

UNCERTAINTY DISCUSSION

1. The FEIS analysis currently estimates the potential change in water depth in Empire Gulch. The FEIS analysis is based on Cienega Creek data only, with almost no field data available from Empire Gulch. Since the proposed approach would be based on new field measurements specific to Empire Gulch, the proposed approach would reduce the uncertainty associated with the FEIS analysis by using field data from Empire Gulch.
2. At a fundamental level, the proposed approach would still rely on changes predicted by the groundwater model, albeit predicted streamflow changes instead of predicted drawdown. The groundwater model has uncertainties associated with the long time frames, long distances, and small drawdowns involved. The fundamental uncertainties associated with the groundwater modeling would not be reduced.
3. At a fundamental level, the actual hydrologic connection of Empire Gulch with the regional aquifer is not understood; the proposed approach would not reduce this uncertainty.
4. Mathematically, flow modeling is appropriate at any scale. However, the streamflow measured in Empire Gulch is quite small—measured in gallons per minute, rather than cubic feet per second. At these low flows, a slight change in stream channel geometry (for instance the presence of a single boulder or a shrub in the channel) can have large consequences. This is a limitation on the accuracy of the technique.
5. Stream channel geometry naturally changes, even year to year, due to erosion and sedimentation. The proposed approach assumes the stream geometry would stay the same indefinitely, which may not be realistic after even one or two storm events.

PROFESSIONAL INTERPRETATIONS

The collection and use of field measurements on Empire Gulch reduces the uncertainty of the existing analysis with respect to depth of water in the stream at any given streamflow.

The ability to accurately model small flows, however, raises the uncertainty of the analysis; edge effects would likely overwhelm the mathematical predictions. This analysis would also ignore the potential for channel losses, and would not speak to the presence or absence of water in the stream channel when streamflow goes to zero.

The open channel modeling also would not address or reduce the fundamental uncertainties associated with the groundwater modeling or conceptual understanding of Empire Gulch, nor would it necessarily be directly applicable in the future due to possible channel shifts.

BRIEFING PAPER
CONSIDERATION OF USGS GENERIC MODEL APPROACH

BACKGROUND

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

One approach discussed was the potential to use a generic groundwater model to better estimate the relationship between aquifer water level changes and streamflow, which was fundamental to the prediction of impacts used in the FEIS. The purpose of this paper is to provide a discussion of this possible approach, the uncertainties involved, and the possible applicability for the Supplemental Biological Assessment.

DESCRIPTION OF GENERIC MODELING APPROACH

Prior to the technical meeting on June 10-11, 2014, Stan Leake of the USGS developed a generic groundwater model with the purpose of investigating the mathematical relationship between streamflow and aquifer water levels.

A generic MODFLOW model was developed that contained a basic aquifer block, with a stream package to simulate streamflow arising from an aquifer. Then a pumping well was applied to the model. The presence of the pumping well causes drawdown in aquifer water levels, and the resulting change in streamflow conditions can be analyzed and plotted against drawdown. Using the output, the numerical relationship between aquifer drawdown and streamflow can be developed.

Purpose of Generic Modeling Approach

The purpose of this approach was to better define the 1:1 relationship used in the FEIS streamflow analysis, in which 1 foot of drawdown in the aquifer was assumed to reduce stream depth by 1 foot. The model was not meant to be used as a stand-alone analysis; it was only meant to be used as a means of refining the analysis contained in the FEIS.

Logistics for Completing (time, effort)

USGS has provided the generic model files. They would need to be opened, run, and output analyzed to establish the drawdown/streamflow relationship. (Time: 2 weeks).

Potential to Reduce Uncertainty or Increase Accuracy

OVERALL CONCLUSIONS

1. The approach would allow for an independent look at the streamflow/drawdown relationship; however, since it is applicable only to the FEIS approach, it would not actually help predict the depth or width of flow in the stream. It would only help predict the presence/absence of flow caused by drawdown.
2. This approach does not resolve any uncertainties associated with the modeling of impacts at extremely long time frames and at long distances. It still assumes the original modeled drawdowns will occur as predicted.
3. This approach assumes that there is a direct hydrologic connection between the stream, the shallow aquifer, and the regional aquifer. It does not resolve any uncertainty regarding the hydrologic framework under which Empire Gulch stream flow arises.
4. The resulting drawdown/streamflow relationship is based entirely on the selected model inputs for stream bottom and the aquifer. It is not based on field measurements or otherwise calibrated.

BRIEFING PAPER
CONSIDERATION OF WET/DRY PROBABILISTIC MODELING

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

This included the discussion of an approach suggested by Rosemont as an alternative to the approach used in the FEIS, using a probabilistic assessment of wet/dry conditions. The purpose of this paper is to provide a discussion of this possible approach, the uncertainties involved, and the possible applicability for the Supplemental Biological Assessment.

Description of Potential Wet/Dry Probabilistic Modeling

This proposed approach is presented by WestLand Resources in their memo titled "Revised Review of SWCA Model and an Alternative Approach to Inform the Effects of Groundwater Drawdown on Cienega Creek", dated June 6, 2014 and revised June 27, 2014.

The overall approach utilizes a data set consisting of 8 years of wet/dry mapping on Cienega Creek (2006-2013). For each year, the length of wetted stream was measured. The resulting data set (n=8) is analyzed to identify an appropriate probability distribution. Both normal and lognormal distributions are analyzed.

The Montgomery groundwater model (presented in the FEIS) predicts a change in wetted stream length. Using the probability distribution from the measured wet/dry data, the modeled data are then used to determine how probable it is in the future that 1) Cienega Creek would have zero miles of wetted stream, 2) Cienega Creek would have less than 1 mile of wetted stream, and 3) Cienega Creek would have less than 4.45 miles of wetted stream (which is a 25% reduction from historic measured stream length). The analysis also provides a graphical probability distribution so that any specific test can be applied by the reader, not just those three presented above.

The same analysis is done for the Tetra Tech model, although an interim step is performed to convert modeled changes in streamflow to modeled change in wetted stream length.

The approach also allows for analysis of climate change scenarios.

Purpose of Wet/Dry Probabilistic Modeling

The purpose of this approach is to address a primary criticism of the FEIS analysis, which is that it predicts loss of streamflow, but cannot predict the presence of standing water in the stream channel. This approach predicts the probability of water being present/absent in the stream channel based on model outputs.

Logistics for Completing (time, effort)

This analysis has already been completed.

Potential to Reduce Uncertainty or Increase Accuracy

FUNDAMENTAL HYDROLOGY ASSUMPTIONS

This approach implicitly relies on the same hydrologic assumptions used in the groundwater models. As such, it assumes a complete hydrologic connection between the regional aquifer and Cienega Creek.

UNCERTAINTY DISCUSSION

1. This analysis does not include any predictions in Empire Gulch, only Cienega Creek. Because of the lack of matched streamflow and wet/dry mapping on Empire Gulch, this approach likely could not be extended to include this area.
2. The probability distribution is based on a limited number of samples (n=8). The range of measured wetted length for these 8 samples between 2006-2013 is 4.5 – 7.84 miles.
3. It is highly unlikely that, using this approach, any scenarios would show stream length going to zero, simply because stream length has never gone to zero in the eight years it has been measured or even come close. It is important to note that this is not a criticism of the approach or the statistics, but a limitation of using a small data set.

   Another way of saying this is as follows: based on the observed data, the shortest wetted stream length ever observed in the 8 years data was collected was 4.5 miles. The Montgomery model predicts that wetted stream length will shrink by 0.16 miles. It doesn't take complex statistics to see that a zero stream length is far beyond anything observed or modeled even when combined.
4. One strength of this approach is the flexibility to pose different questions that might be of more interest. For instance, perhaps we feel that an 80% certainty is appropriate for our predictions. Then we can say: with 80% probability, what is likely to happen on Cienega Creek if we see impacts from both the mine and climate change? (Answer: see Figures 29 and 30. At 150 years after mine closure, there is an 80% probability that wetted stream length will be at least 2.2 miles, and at 1000 years after mine closure, wetted stream length will be at least 1 mile.).

PROFESSIONAL INTERPRETATIONS

1. This approach provides a prediction that is not covered by any other analysis—the presence/absence of water in the channel. It is compatible to be used in conjunction with other approaches.
2. This approach is not useful for predicting any impacts to Empire Gulch. Potentially the data could be developed to apply to Empire Gulch by developing a longer record of streamflow measurements to match wet/dry mapping. This approach possibly could be used during the mine life to continually reassess impacts.
3. While the probability distribution is such that very bad outcomes are almost impossible, this is not a flaw but could be a limitation. Rather it is an accurate reflection of the existing wet/dry data observed on the channel for the 8 year period of record.
4. This approach does not resolve any uncertainties associated with the modeling of impacts at extremely long time frames and at long distances. It assumes the modeled impacts will occur as predicted.

5. This approach does not resolve any uncertainties about the exact hydrologic source of water. It assumes there is complete hydrologic connection between regional aquifer, shallow aquifer, and streamflow.

BRIEFING PAPER
EPA RISK ASSESSMENT APPROACH

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

On 6/30/14, the EPA provided to the Coronado National Forest a paper entitled "Draft Proposal for Collaborative Review of Ecological Risk". This paper reiterates an approach originally suggested by the EPA in the fall of 2013. In lieu of this approach, the Coronado National Forest undertook a collaborative revision of the streamflow analysis contained in the FEIS. The approach was raised again by EPA during the June 10-11 meeting. The latest EPA proposal is attached to this paper in its entirety.

Description of Proposed Risk Assessment Approach

Overall, the approach involves a collaborative review of the entire body of evidence related to Cienega Creek and Empire Gulch, using the following components:

1. Multiple opinions are considered.
2. Each piece of evidence is weighted as to strength and quality.
3. A consistent risk-based review approach is designed, in the form of a matrix (see example attached).
4. Assessment questions/problem statements are developed.
5. Multi-agency meetings are convened to collaboratively fill in the matrix.

Purpose of Proposed Risk Assessment Approach

The purpose of this approach is described as follows: "Combining various lines of evidence reduces the chances of making erroneous conclusions based on a single line of evidence (e.g., only relying on numerical models with limited accuracy). It also allows for a balanced consideration and merging of different types of information, thereby building even greater understanding of the potential ecological impacts."

Logistics for Completing (time, effort)

While this would be collaborative approach utilizing multiple agencies, the intent would be for EPA to manage the review. EPA estimates this effort would take approximately 4-6 months to complete.

Potential to Reduce Uncertainty or Increase Accuracy

1. This approach fundamentally relies on all of the other data and approaches brought forward during this current process. As such, it does not actually reduce the uncertainty of any particular piece of data or analysis. Rather, it simply ensures that no one piece of data is solely responsible for conclusions or predictions.
2. The proposed approach allows for multiple points of view to be considered. This is not fundamentally different from the goal of the current meetings/discussions.

3 This approach assumes that a body of evidence already exists, but is not designed to search out and identify new information.

DRAFT PROPOSAL FOR COLLABORATIVE REVIEW OF ECOLOGICAL RISK ROSEMONT MINE PROJECT

GENERAL APPROACH

The Environmental Protection Agency has recommended that a risk-based approach be used to evaluate existing information about the potential ecological impacts from the proposed Rosemont Mine Project and make predictions about the ecological risks. The approach may be applied as a collaborative activity, and with the aid of a relatively simple, conceptual model. The risk-based approach is centered on the concept of weight-of-evidence, which includes a generally agreed upon set of narrative criteria for evaluating information from the existing technical record. Results of the review may be visually displayed in a straightforward matrix (e.g., Table 1), and would also provide information on what types/levels of mitigation would be necessary to offset/compensate for adverse impacts. It is presumed that there may be more than one opinion of overall ecological risk attributed to the proposed project based on use of the approach, and multiple opinions can be reported.

Weight of Evidence and Risk-Based Assessment

The proposed Rosemont Mine Project is located is the Cienega Creek watershed. The watershed is valued for many of its unique environmental qualities. Weighing the risks of mine development is a means to make well-reasoned decisions in the face of uncertainty over impacts to the Cienega Creek watershed and beyond. In particular, there is considerable uncertainty about how well the current groundwater models used in the NEPA analysis can predict the intensity, duration and extent of impacts expected from the proposed project. This uncertainty relates to both concerns over the accuracy of the models, as well as understanding the ecological sensitivity of the affected watersheds.

In light of such high uncertainty and risk, it is often useful to look at several related, yet independent types of information to inform a decision. We can combine these pieces of evidence, weigh each piece as to strength and quality, and then weigh all the categories of evidence to reach a conclusion. This "weight-of-evidence" approach may be used to build an understanding of likely environmental outcomes from the proposed project. Combining various lines of evidence reduces the chances of making erroneous conclusions based on a single line of evidence (*e.g.*, only relying on numerical models with limited accuracy). It also allows for a balanced consideration and merging of different types of information, thereby building even greater understanding of the potential ecological impacts.

Steps for Collaborative Risk-Based Assessment

The following steps describe preparations for the proposed risk-based assessment, the actual review and the reporting of results. The process is expected to take 4-6 months.

The steps are:

1. Develop a simple conceptual risk-based assessment review approach, including description of assumptions
    - The matrix in **Table 1** is a representation of a risk-based review approach. The approach will be refined and made more explicit with narrative descriptions of each of its elements (e.g., "cells" in the draft matrix).
2. Provide technical rationale for the approach.

- The conceptual approach brings together concepts from landscape ecology, comparative risk assessment and the use of weight of evidence in decision-making. Pertinent background information will be summarized for each concept.

3. Develop general rules and narrative criteria.
    - Key aspects of this step are gaining consensus on the "problem statement/assessment question," and plainly describing the assumptions used in the review.
4. Convene agency expert team to complete the risk matrix.
    - Convene two or three agency meetings where groups of agency experts work to complete the risk matrix.
5. Report results of review.
    - If more than one risk scenario (opinion) evolves from the review of project risk, the review team will decide how best to present differing risk statements (opinions).

Table 1 shows how determinations of impact risks are grouped and formated into a matrix (or "score card"). The matrix has four components. The first component is the environmental attributes of an aquatic landscape that may be impacted by a project: (a) its "watershed profile;" (b) aquatic life that is dependent on the watershed profile; and (c) occurrence of a special status area. A special status area is informally understood to be an area with well-known capacity for provisioning specific ecosystem services or that supports regionally significant wildlife resources. The spatial extent of a special status area may vary by the type of ecosystem service and wildlife resource under consideration.

The second component is the types of environmental stressors typically associated with large scale projects. Stressor type includes consideration of the duration and intensity of a stressor's effect on the aquatic landscape.

The third component is narrative criteria used to evaluate the magnitude of risk of a stressor on the environmental attributes of an aquatic landscape.

The fourth component is the "scoring cells" within the matrix used to show results of the review. The scoring cells are organized in a hierarchical way. Lines of evidence are gathered together in an upward direction within each "column" of the matrix. Risk is then summarized for the three main landscape attributes: Landscape function, aquatic life and special status area.

Table 1. Reviweing Risk of Project Impacts

Assessment Question: _____

	Affected Attributes of Ecosystems and Landscapes								
Risk Factors→	Affect Landscape Function and Sensitivity to Future Impacts ("Alter Watershed Profile") ○						Affect Aquatic Life, including its Sensitivity to Future Impacts ○		Affect Special Status Natural Area or Ecosystem Service Area ○
Project Impacts To the Aquatic Environment↓	e.g. Headwater Network Including Springs ○			e.g. Main Stem Stream Reaches ○			Communities: Ecosystem patches	Special Status Species: Habitat patches	Proportion of area affected
	Abundance	Distribution	Condition	Abundance	Distribution	Condition			
	○	○	○	○	○	○	○	○	○
Conversion of Aquatic Landscape to Developed Landscape	○	○	○	○	○	○	○	○	○
Hydromodification Of Aquatic Landscape	○	○	○	○	○	○	○	○	○
Water Quality Degradation of Aquatic Landscape	○	○	○	○	○	○	○	○	○
Review and Scoring: Scoring is conducted using the criterion described in Section 3.0. Low Risk ○ Moderate Risk ○ High Risk ○									

BRIEFING PAPER
PROPOSED INTERPRETATION OF UPPER EMPIRE GULCH SPRING SOURCE FROM HYDRO-LOGIC

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

As a result of this request, on behalf of Rosemont Copper, Hydro-Logic prepared a technical memorandum summarizing the results of revised groundwater modeling, as well as proposing a new interpretation for the potential source of and possible impact to the Upper Empire Gulch Springs[1].

Description of Proposed Approach using HydroLogic Intepretation

Hydro-Logic posits that Upper Empire Gulch spring arises from the regional aquifer. This is not a new interpretation, and in fact is the fundamental interpretation used throughout the FEIS and in most subsequent analyses. However, to support this interpretation Hydro-Logic presents information obtained from a nearby well drilled into the regional aquifer in 1970 (referred to as Test Well No. 2). This well is located perhaps 1,500 feet from the Upper Empire Gulch springs.

Test Well No. 2 is 845 feet deep, which should indeed place it well into the regional aquifer.
The remarkable thing about Test Well No. 2 is that it is a flowing well, with a piezometric head that is above land surface. When drilled in 1970, the well began to flow when a depth of 331 feet was reached. Recent measurements show that the well remains artesian, with a piezometric head of 28 feet above land surface in 2006.

It was this water level that was used in the groundwater model to define the piezometric surface, and the drawdown in the regional aquifer predicted by the model (6 feet) theoretically may not be a physical lowering of groundwater in the vicinity of the spring, but rather a reduction in the piezometric head from 28 to 22 feet above land surface.

Hydro-Logic indicates that this 6 foot change in piezometric head would reduce the modeled spring flow from 8.4 to 6.9 gallons per minute after 1,000 years, but would not result in the complete loss of flow.

Purpose of Hydro-Logic Interpretation

The purpose of the using the Hydro-Logic interpretation would be to predict the change in Upper Empire Gulch spring flow due to modeled drawdown, based on the closest regional well.

[1] 2014. HydroLogic. Simulated Empire Gulch Spring Discharge and Stream Flows based on the Tetra Tech (2010) Groundwater Flow Model. June 27, 2014.

Logistics for Completing (time, effort)

This work is already conducted.

Potential to Reduce Uncertainty or Increase Accuracy

FUNDAMENTAL HYDROLOGY ASSUMPTIONS

This approach makes a fundamental assumption that there Upper Empire Gulch Springs arises solely from the regional aquifer, and that the confined nature seen in Test Well No. 2 is similar to that experienced by the springs.

UNCERTAINTY DISCUSSION

At a fundamental level, the proposed approach would still rely on changes predicted by the groundwater model. The groundwater model has uncertainties associated with the long time frames, long distances, and small drawdowns involved. The fundamental uncertainties associated with the groundwater modeling would not be reduced.

PROFESSIONAL INTERPRETATIONS

This approach is a fundamental shift from the other analyses being conducted. Those analyses all assume there is a complete hydrologic connection between streamflow, any shallow alluvial aquifer, and regional aquifer, and that change in one directly affects the others. Therefore a drawdown of 6 feet as modeled is assumed to convey a physical drop in shallow water levels by 6 feet in both the regional aquifer and any shallow alluvial aquifer, with resulting impacts on streamflow.

By contrast, the Hydro-Logic interpretation would assume that the springs are the sole source of water to Upper Empire Gulch, and therefore the streamflow is tied solely to the regional aquifer. Drawdown would not affect water flowing in the channel or present in the shallow alluvial aquifer, but would only affect the stream by reducing flow from the Upper Empire Gulch springs.

It is unlikely that either scenario is fully correct. Isotope data suggest that water from Empire Gulch is a mix of regional water and more localized water.

BRIEFING PAPER
CONSIDERATION OF NEW INFORMATION FOR FEIS STREAMFLOW ANALYSIS

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

During this process, several aspects of the streamflow analysis used in the FEIS were reviewed in light of other possible approaches and new information obtained after publication of the FEIS. In response to these concerns, the Forest Service directed SWCA Consulting (SWCA) to review additional information obtained after the publication of the FEIS and determine whether the analysis could be further refined to reduce uncertainty.

The results of the refined analysis are summarized elsewhere. The purpose of this paper is to provide a discussion of the overall approach, the uncertainties involved, and the possible applicability for the Supplemental Biological Assessment.

Description of Refinement of Streamflow Analysis

SWCA refined the streamflow analysis used in the FEIS to incorporate additional information. In general, this approach takes a measured historic stream hydrograph, assumes that the same hydrograph would occur in the future, and then superimposes changes on the hydrograph to reflect hydrologic changes in the aquifer due to mine drawdown.

The FEIS analysis is based on depth of water, and uses a 1:1 relationship to link modeled aquifer drawdown to drawdown within the stream channel. In large part it is the appropriateness of this 1:1 assumed relationship that has been questioned and has driven the need to refine the approach. Criticism has focused primarily on the complex mathematical relationship between groundwater inflow to a stream and the resulting depth of water in a stream channel (the first driven by Darcy's Law, the second driven by Manning's Equation), and the concern that without field measurements to calibrate the relationship the choice of 1:1 is arbitrary. To assess the appropriateness of using the 1:1 relationship requires paired measurements of streamflow or stream depth, and groundwater levels. At the time the FEIS analysis was conducted, such paired data were not available.

New data were made available to the Forest Service by the Bureau of Land Management (BLM) after the FEIS was released that made it possible to further refine the FEIS approach. These data include:

- Piezometer/streamflow data on both Empire Gulch and Cienega Creek (collected by BLM) that allow an empirical relationship between aquifer water level and streamflow to be calculated.
- Similarly, aquifer water levels that can be matched with flow at the USGS gage on Cienega Creek, establishing an empirical relationship there as well.

- These data establish a demonstrable correlation between drawdown in the aquifer and flow in the streams. This correlation was used to replace the 1:1 assumption in the FEIS analysis. This allows another method of superimposing impacts on the stream hydrographs that addresses the concerns about using the 1:1 relationship.
- In addition, predicted changes in streamflow have been modeled for both Empire Gulch and Cienega Creek.

The same statistics as used in the FEIS have been calculated, including "dry days", (which is more properly termed "days with zero flow", and "extremely low flow days"). These statistics are translated into narrative descriptions: perennial (0-30 no flow days), intermittent (31-350 no flow days), and ephemeral (>350 no flow days).

Purpose of Refined Analysis

The purpose of the refined analysis is to further test the assumptions used in the FEIS analysis that predict the change in streamflow due to a modeled aquifer drawdown. Neither the FEIS analysis nor this refined analysis predict the presence or absence of water in the channel, as water can be present while streamflow is nonexistent in the form of pools.

Logistics for Completing (time, effort)

This analysis is complete. See attached draft memo.

Potential to Reduce Uncertainty or Increase Accuracy

FUNDAMENTAL HYDROLOGY ASSUMPTIONS

This approach makes a fundamental assumption that there is a causal link between shallow aquifer levels and measured streamflow. To be more specific, it assumes that lower streamflow is caused by lower water levels in the shallow aquifer. This is not the only explanation: an alternative hypothesis would be that streamflow and water levels both change in synch due to the same stresses (i.e. riparian vegetation Evapotranspiration (ET), but that one doesn't cause the other. The former assumption (that aquifer and streamflow are linked) was selected in part due to Forest Service policy that suggests in the absence of conclusive data to the contrary, a hydrologic connection is assumed between groundwater and surface water.

This approach also makes a fundamental assumption that changes in the regional aquifer due to mine drawdown will result in similar drawdown in shallow water levels near Empire Gulch or Cienega Creek. In other words, this approach assumes a complete hydrologic connection exists between regional aquifer, shallow alluvial aquifer, and streamflow.

UNCERTAINTY DISCUSSION

1. The piezometers and streamflow measurements collected by BLM are located close together spatially, and therefore are reasonable to pair. The Empire Gulch piezometer is approximately 100 meters from the BLM Empire Gulch streamflow measurement location. The Upper Cienega Creek piezometer is approximately 6 meters from the BLM Upper Cienega Creek streamflow measurement location. Based on available data, the piezometers appear to be located within the floodplain, very close to the active stream channel.
2. The well ("Frog Well") located near the USGS Upper Cienega Creek streamgage is not quite as close, being approximately 784 meters distant.

3. For the BLM piezometer/streamflow pairings, a limiting factor is the number of streamflow measurements. For Empire Gulch there are 21 measurements that span a continuous period of 20 months, approximately one per month. For Upper Cienega Creek there are 19 measurements that span a continuous period of 20 months, approximately one per month.
4. The linear correlation used for BLM data on Empire Gulch (n=21) has an $R^2 = 0.71$, which means that a linear regression explains 71% of the variability in streamflow. The standard error of regression (S) = 4.3, which means that the average residual of the predicted to actual streamflow is 4.3 gallons per minute (gpm). The linear relationship describes 1 foot of drawdown in the piezometer equaling a reduction of 10.9 gpm in streamflow; the 95% confidence interval for this is 7.6 – 14.3 gpm/1 foot drawdown and the 80% confidence interval for this is 8.8 – 13.0 gpm/1 foot drawdown.
5. The linear correlation used for BLM data on Upper Cienega Creek (n=19) has an $R^2 = 0.59$, and S = 21.4 gpm. The linear relationship describes 1 foot of drawdown in the piezometer equaling a reduction of 118 gpm in streamflow; the 95% confidence interval for this is 67 – 168 gpm/1 foot drawdown and the 80% confidence interval for this is 86 – 150 gpm/1 foot drawdown.
6. For the USGS streamgage/Frog Well relationship, the limiting factor is the number of water level measurements in Frog Well, which is 21 measurements spanning a period of 26 months.
7. The linear correlation used for the USGS Streamgage/Frog Well (n=21) has an $R^2 = 0.45$, and S = 109 gpm. The linear relationship describes 1 foot of drawdown in Frog Well equaling a reduction of 189 gpm in streamflow; the 95% confidence interval for this is 90 – 288 gpm/1 foot drawdown and the 80% confidence interval for this is 126 – 252 gpm/1 foot drawdown.

PROFESSIONAL INTERPRETATIONS

1. This approach does not resolve any uncertainties associated with the modeling of impacts at extremely long time frames and at long distances as described in the FEIS. It still assumes the modeled drawdowns will occur as predicted.
2. This approach does not resolve any uncertainties about the exact hydrologic source of water in Empire Gulch. It assumes there is complete hydrologic connection between regional aquifer, shallow aquifer, and streamflow.
3. This approach does not resolve any uncertainties associated with presence/absence of water in the stream channel. It only predicts changes in streamflow.
4. However, this approach does resolve the uncertainty associated the 1:1 relationship used in the FEIS. It replaces that assumption with an empirical relationship and places probability bounds on the numerical relationship between streamflow and aquifer drawdown. This reduces the uncertainty in two ways. First, the stream/aquifer relationship is not arbitrary but is supported by field data. Second, the uncertainty that still exists in the stream/aquifer relationship can be quantitatively defined and accounted for.

BRIEFING PAPER
CONSIDERATION OF FISH HABITAT MODELING

Background

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

During this process, several new approaches were proposed in concept. One of these approaches was the use of fish habitat modeling to better describe the potential impacts to the aquatic environment, due to changes in hydrology. The purpose of this paper is to provide a discussion of this possible approach, the uncertainties involved, and the possible applicability for the Supplemental Biological Assessment.

Description of Proposed Approach using Fish Habitat Modeling

There are a wide variety of fish habitat models available for use, and this paper will not attempt to describe these in detail. Instead, this paper will focus on a common fish habitat model and the inputs/outputs needed to run it.

Physical Habitat Simulation System (PHABSIM) is one technique under an overall conceptual methodology known as Instream Flow Incremental Methodology (IFIM). This methodology allows predictions of impacts on aquatic species due to incremental changes in stream conditions. PHABSIM is one of the most widespread and commonly used fish habitat models.

PHABSIM is mostly a tool that connects changes in physical microhabitat to changes in stream flow, which is just one part of a comprehensive IFIM protocol. Note that the IFIM approach as a whole incorporates a wider variety of inputs, including changes in water quality and energy inputs.

Inputs

- Habitat Sensitivity Indices (HSI). These are correlations or curves that show the relationship between a physical variable (velocity, pool habitat, temperature) and presence/abundance of a species or acceptability of habitat for a species. If HSI do not exist for the species of interest, field data collection is often required in order to develop them prior to running PHABSIM. <u>These curves are species-specific.</u>
- Cross-sections. The hydraulic modeling requires detailed cross-sections that will be representative of key habitat.
- Depending on the technique used for hydraulic modeling, a series of discharge measurements may need to be collected in the stream (i.e., develop a rating curve). However, several other techniques are also available that do not require field data collection, including use of Manning's equation or the Standard Step Backwater method to mathematically relate discharge to depth/velocity.

- Velocity profiles are also needed, and can either be measured in the field for a range of streamflows, or calculated mathematically.
- A range of discharge that is of interest needs to be selected.

Modeling and Output

Based on these inputs, the PHABSIM model will use hydraulic modeling to predict various hydraulic parameters (depth, velocity) for a given value of discharge. These parameters are then translated, using the HSI curves, into a measure of overall habitat suitability at any given discharge.

Purpose of Fish Habitat Modeling

The purpose of the fish habitat modeling is to predict the suitability of habitat at a given streamflow.

Logistics for Completing (time, effort)

Unknown. Using PHABSIM properly requires a high level of expertise, but at least two involved agencies (USFWS and USGS) may have this level of expertise.

The hydrologic inputs would be relatively rapid to develop (i.e., cross-sections, flow measurements), and probably could be done within a few weeks. The HSI inputs—if not already existing—would likely involve a complex research methodology and could take much longer to develop (maybe 3-6 months).

Potential to Reduce Uncertainty or Increase Accuracy

UNCERTAINTY DISCUSSION

1. This approach is highly similar to the open-channel modeling approach; in essence, the same hydraulic modeling underlies both approaches. The same uncertainties exist as well:
    a. At a fundamental level, the proposed approach would still rely on changes predicted by the groundwater model, albeit predicted streamflow changes instead of predicted drawdown. The groundwater model has uncertainties associated with the long time frames, long distances, and small drawdowns involved. The fundamental uncertainties associated with the groundwater modeling would not be reduced.
    b. At a fundamental level, the actual hydrologic connection of Empire Gulch with the regional aquifer is not understood; the proposed approach would not reduce this uncertainty.
    c. Mathematically, flow modeling is appropriate at any scale. However, the streamflow measured in Empire Gulch is quite small—measured in gallons per minute, rather than cubic feet per second. At these low flows, a slight change in stream channel geometry (for instance the presence of a single boulder or a shrub in the channel) can have large consequences. This is a limitation on the accuracy of the technique.
    d. Stream channel geometry naturally changes, even year to year, due to erosion and sedimentation. The proposed approach assumes the stream geometry would stay the same indefinitely, which may not be realistic even after several large flow events.
2 This approach also requires detailed HSI curves for the specific aquatic species of interest. It is not known if these exist.

PROFESSIONAL INTERPRETATIONS

While this approach provides a link between the hydrologic changes that could be seen in the channel and the impact on aquatic species, it does not resolve many of the fundamental uncertainties.

The ability to accurately model small flows raises the uncertainty of the analysis to a great degree; the edge effects that are present with small flows are likely to render the solution highly uncertain. This analysis also ignores the potential for channel losses, and does not speak to the presence or absence of water in the stream channel when streamflow goes to zero.

The hydraulic modeling also does not address or reduce the fundamental uncertainties associated with the groundwater modeling or conceptual understanding of Empire Gulch, nor is it necessarily directly applicable a long time in the future due to possible channel shifts.

BRIEFING PAPER
CONSIDERATION OF STREAMFLOW/WATER LEVEL CORRELATIONS ON LOWER CIENEGA CREEK

BACKGROUND

Following release of the Rosemont Copper Project Final Environmental Impact Statement (FEIS) in December 2013, several factors including the receipt of new hydrological and biological information resulted in a decision in May 2014 by the Coronado National Forest to reinitiate Section 7 consultation. In preparation for this step, the Coronado National Forest requested input from cooperators, federal agencies and other interested parties about analysis that could be incorporated into a Supplemental Biological Assessment. A meeting was held on June 10-11, 2014 to discuss possible approaches and available data sources, and additional information was subsequently requested from the meeting participants.

During this process, Pima County presented an analysis of streamflow/water level correlations on Lower Cienega Creek. This analysis is similar to one that WestLand Resources prepared prior to publication of the FEIS during the initial Section 7 consultation[1].

DESCRIPTION OF PROPOSED APPROACH USING WATER LEVEL CORRELATIONS

In both cases (Pima County and WestLand), water levels for wells adjacent to Lower Cienega Creek are correlated with either streamflow on Lower Cienega Creek or the wetted length of the stream. These correlations provide a potential method to predict impacts to Lower Cienega Creek that could occur because of modeled drawdown.

In the case of Pima County, a multiple regression was conducted using both miles of flow (i.e., wet/dry mapping) and discharge measurements, compared against water levels from the Cienega well.

In the case of WestLand, a linear regression was conducted using miles of flow, compared to water levels in the Cienega Well and the Jungle Well. The relationship between the Jungle Well water levels and wetted stream length on Lower Cienega Creek was found to be the most useful for predicting potential impacts.

Purpose of Water Level Correlations

The purpose of the using these correlations would be to predict the potential reduction in wetted stream length on Lower Cienega Creek due to modeled drawdown, or the change in streamflow on Lower Cienega Creek due to modeled drawdown.

Logistics for Completing (time, effort)

This work is already conducted.

[1] WestLand Resources. 2012. Rosemont Copper Project: Potential Effects of the Rosemont Project on Lower Cienega Creek. November 14, 2012.

Potential to Reduce Uncertainty or Increase Accuracy

FUNDAMENTAL HYDROLOGY ASSUMPTIONS

- This approach makes a fundamental assumption that there is a causal link between shallow aquifer levels and measured streamflow or wetted length of stream. To be more specific, it assumes that lower streamflow is caused by lower water levels in the shallow aquifer. This is not the only explanation: an alternative hypothesis would be that streamflow and water levels both change in synch due to the same stresses (i.e. riparian vegetation evapotranspiration (ET)), but that one doesn't cause the other.
- This approach also makes a fundamental assumption that changes in the regional aquifer due to mine drawdown will result in similar drawdown in shallow water levels near Lower Cienega Creek. In other words, this approach assumes a complete hydrologic connection exists between regional aquifer, shallow alluvial aquifer, and streamflow.

UNCERTAINTY DISCUSSION

1. The linear correlation by Pima County for Cienega well water levels and wetted length of stream has an $R^2 = 0.70$, which means that the measured water levels explain 70% of the variability in wetted stream length. The actual regression equations were not provided.
2. The linear correlation by Pima County for Cienega well water levels and streamflow has an $R^2 = 0.64$, which means that the measured water levels explain 64% of the variability in discharge. The actual regression equations were not provided
3. The linear correlation by WestLand for Jungle Well water levels and wetted length of stream has an R2 = 0.49, which means that the measured water levels explain 49% of the variability in wetted stream length. The regression equation indicates that a change in water level of 1 foot would result in a reduced wetted stream length of 437 feet.
4. At a fundamental level, the proposed approach would still rely on changes predicted by the groundwater model. The groundwater model has uncertainties associated with the long time frames, long distances, and small drawdowns involved. The fundamental uncertainties associated with the groundwater modeling would not be reduced.
5. This approach solely looks at contribution to baseflow from groundwater and does not consider possible changes to upstream hydrology on Upper Cienega Creek.

PROFESSIONAL INTERPRETATIONS

This approach would allow for direct predictions of potential impact along Lower Cienega Creek due to aquifer drawdown.

However, it has to be noted that the drawdowns predicted along Lower Cienega Creek are quite small (after 1,000 years, 0.1 feet of drawdown at the Cienega Creek/Davidson Canyon confluence is the greatest drawdown observed in any of the model sensitivity runs). Impacts directly from drawdown are not the primary concern on Lower Cienega Creek. The primary concern on Lower Cienega Creek is the propagation of flow impacts from Upper Cienega Creek downstream.

This approach is useful, but cannot be used as the only predictor of impacts on Lower Cienega Creek.

From:	Vogel, Mindy S -FS
To:	Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; nparetti@usgs.gov; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov); msdaversa@blm.gov; blomeli@blm.gov; nparetti@usgs.gov; drpool@usgs.gov; Jesse Dickinson (jdickins@usgs.gov)
Cc:	Victoria Boyne
Subject:	RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting
Date:	Wednesday, July 30, 2014 2:28:21 PM
Attachments:	removed.txt image003.png image004.png HydroBioMeeting_072314.pdf Fed_Working_Group_notes_072314.pdf

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Sorry – I also meant to include the powerpoint presentation. Here it is with the notes so you can delete the first message ☺

CNF_email_sign

From: Vogel, Mindy S -FS
Sent: Wednesday, July 30, 2014 2:26 PM
To: Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; 'abarclay@swca.com'; 'jean_calhoun@fws.gov'; jason_douglas@fws.gov; 'cfsmith@usgs.gov'; 'leenhout@usgs.gov'; 'alcoes@usgs.gov'; 'JESSOP.CARTER@EPA.GOV'; 'Marjorie.E.Blaine@usace.army.mil'; 'Leidy, Robert'; nparetti@usgs.gov; 'Goldmann, Elizabeth'; 'Jeffrey Simms'; 'Moore, Daniel'; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; 'blomeli@blm.gov'; 'cgarrett@swca.com'; 'Melissa Polm (mpolm@swca.com)'; Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov); 'msdaversa@blm.gov'; blomeli@blm.gov; nparetti@usgs.gov; drpool@usgs.gov; Jesse Dickinson (jdickins@usgs.gov)
Subject: RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

Hi Team

Attached are the notes (below the agenda) from last week's meeting in addition to the task with follow-up items. Please note, the last page indicates that we are asking for all the additional information to be posted to the client server by August 8th (many of you are already aware of this date).

If you have any questions or concerns, please contact me.
Thanks!!

CNF_email_sign

From: Vogel, Mindy S -FS
Sent: Friday, July 18, 2014 2:30 PM
To: Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; leenhout@usgs.gov; alcoes@usgs.gov; JESSOP.CARTER@EPA.GOV; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov)
Subject: RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

Hi Team.

Attached you will find a number of documents for the upcoming meeting on June 23rd for the federal agency working group on the Rosemont Copper project. The agenda includes the time, location, and dial in instructions. The purpose for the meeting is described in the agenda as well as below in the original email from the FS to this group.

I am also attaching:

(1) a summary of all the data and information reports that were turned in to the FS since the last meeting in June. Hopefully you have already had a chance to review this information as it was posted to the client share site at t[redacted (b) (6)].

(2) Nine (9) briefing papers on different approaches that were presented at the last meeting. These will be discussed briefly by Chris Garrett at the start of the meeting on 7/23.

Please forward this message on only to others in your agency whom I may have missed that will be participating in this meeting.

If you have any questions, please feel free to contact me (info below).
Thanks!!

CNF_email_sign

From: Ruyle, Jennifer -FS
Sent: Friday, June 27, 2014 4:04 PM
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; JESSOP.CARTER@EPA.GOV; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; Ruyle, Jennifer -FS; cgarrett@swca.com; Melissa Polm (mpolm@swca.com)
Cc: Marjorie.E.Blaine@usace.army.mil
Subject: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

As part of the follow-up to the hydrology working group meeting on June 10-11, we would like to meet with the sub-set of Federal agency participants on July 23rd, all day. The purpose of the meeting will be to review and discuss selected possible analysis approaches that could be used in the Section 7 process to describe future impacts to aquatic and riparian systems. The specific goal of the meeting will be to discuss the information presented in a series of draft briefing papers prepared by the Forest Service, in order to identify which approaches would decrease uncertainty or increase accuracy compared to existing analysis. Briefing papers will be distributed prior to the meeting to allow adequate time for review. The meeting location is yet to be determined, but we will make sure there is video conferencing capabilities for those unable to attend in person. Please let me know if you are able (or not) to attend. Thanks!

Jennifer Ruyle
Natural Resources and Planning Staff Officer

Forest Service
Coronado National Forest, Supervisor's Office

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Caring for the land and serving people

********** ATTACHMENT REMOVED **********

This message contained an attachment which the administrator has caused to be removed.

********** ATTACHMENT REMOVED **********

Attachment name: [image001.jpg]
Attachment type: [image/jpeg]

Federal Agency Hydrology / Biology Meeting

July 23, 2014

Presentation By: Chris Garrett, SWCA

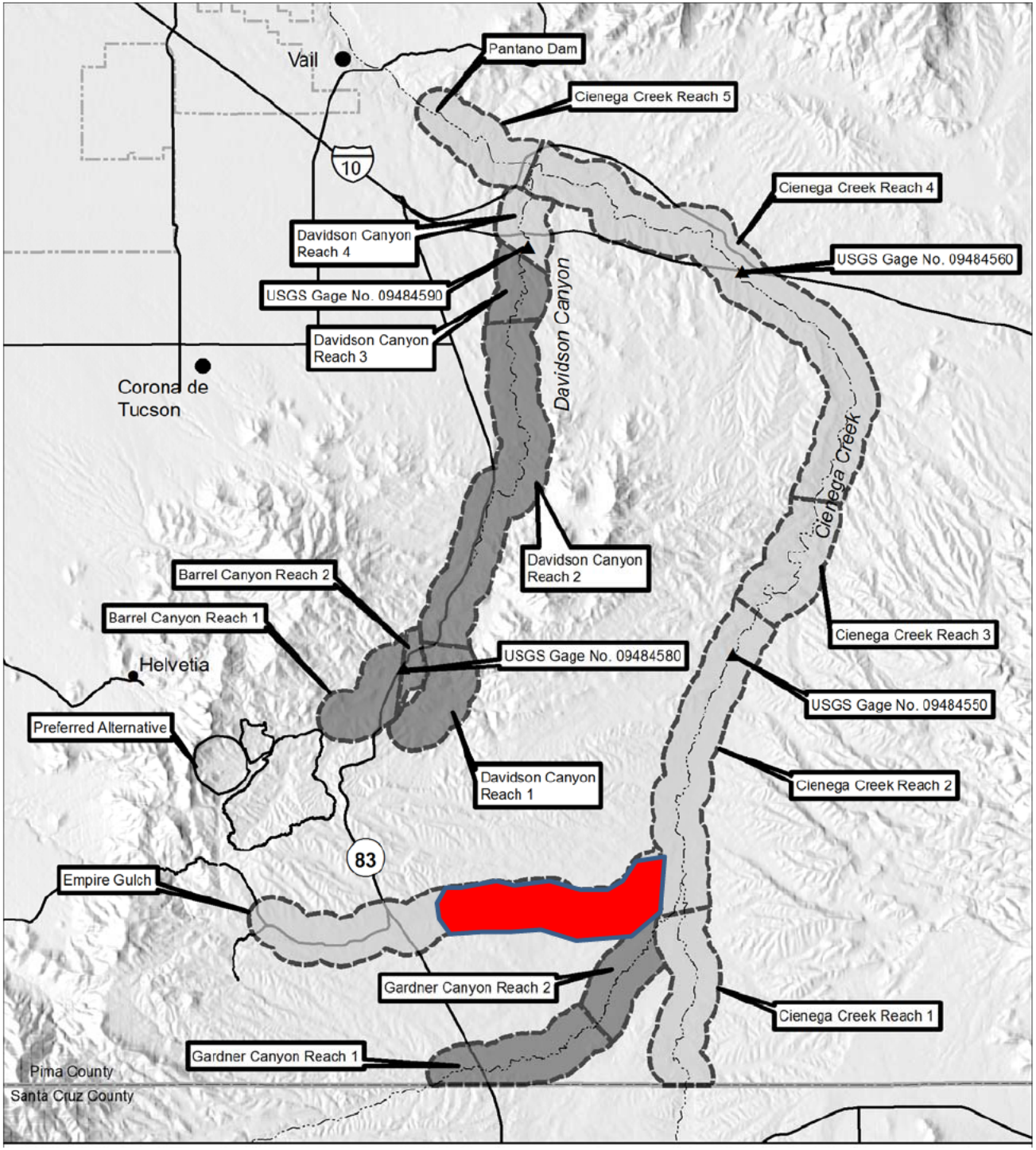
Status of Reinitiation Process:

- 5/23/14 – Forest intent to reinitiate
- 6/10-11/14 – Initial meeting of interested parties to discuss approaches and available data
- 6/13/14 – Forest request for information
- Late June-Mid July – Submittal of information and various field trips
- 7/23/14 – Meeting of federal agencies

Current Process

- Directed by Jim Upchurch to work with cooperating and other agencies to refine hydrology/biology analysis
- Tech memos to document new information
- Briefing papers to discuss possible approaches
- Decision on which approaches should be used
- Conduct/refine analyses as warranted
- Supplemental Information Report
- Supplemental Biological Assessment

Summary of Available Information – Biological/Ecosystem Baseline



Empire Gulch

Empire Gulch Monitoring Report

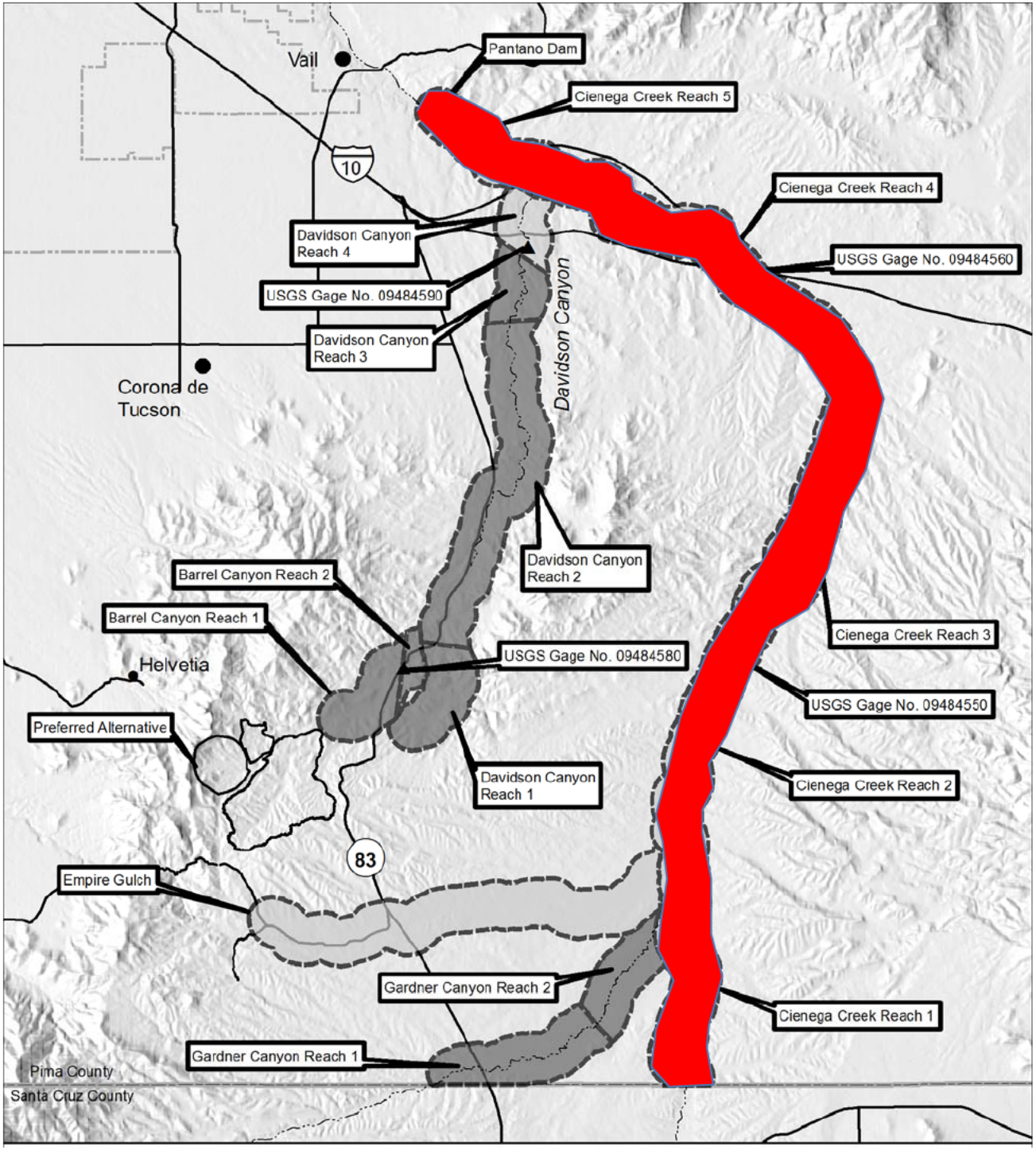
Includes counts of 5 T&E species from 2004-2013

Photo Points

1989, 1993, 2006

HOBO Air Temperature Data

Dec 2009-March 2010



Cienega Creek

Cienega Creek Fish Surveys 2005 – Gila chub status investigation

2005 Foster Simms report

Gila Chub Monitoring in Cienega Creek in 2005, 2007, 2008, 2011and 2012

2014 draft Simms Ehret report

Photo Points

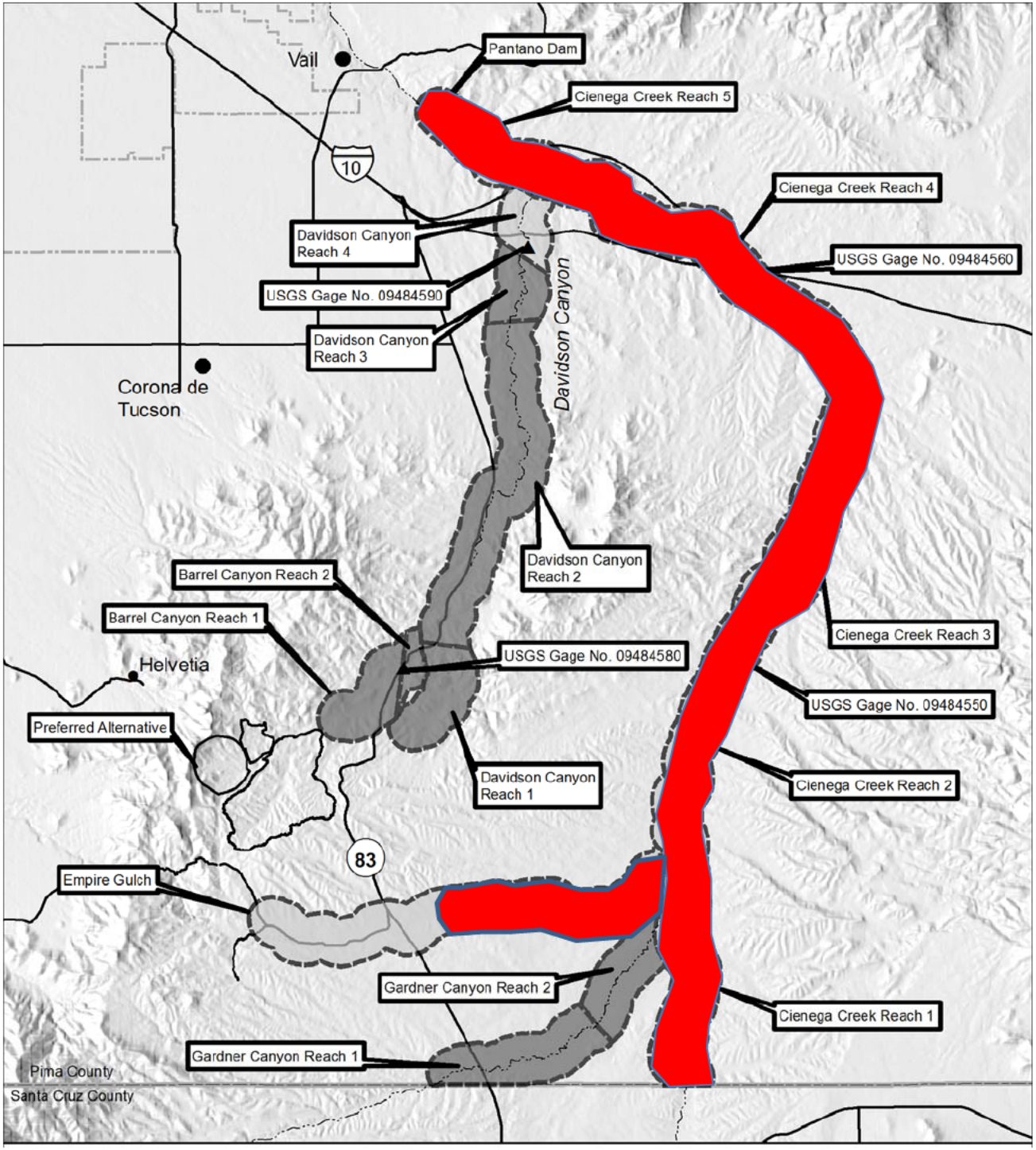
1989, 1993, 2006

HOBO Air Temperature Data

Jan 2012-July 2012
Two locations ("above bend" and "below bend")

Riparian Tree Density

Riparian tree counts for 1993 and 2006



Entire LCNCA

Aquatic Species Reintroduction Data

Locations and dates for initial stocking, augmentation, and new sites considered, for 5 T&E species

Herp Sightings

Notes on 45 herp observations between 1989 and 2004

RACE Assessment Results

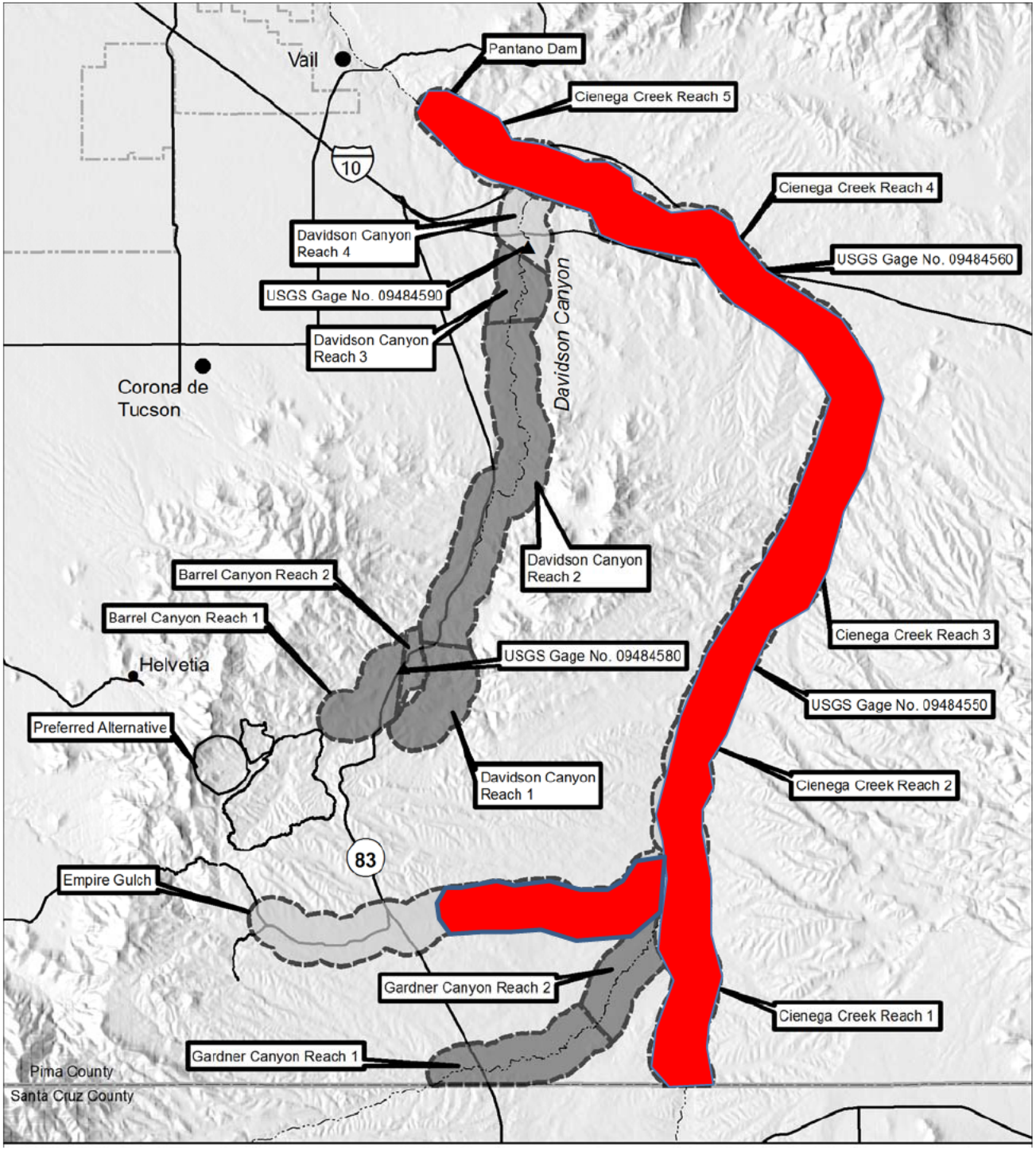
1988-2004 (4 events)

Condition and Trend of Riparian Target Species, Vegetation and Channel Geomorphology

2008 Bodner Simms report

Gila Topminnow population status and trends 1989-2005

2007 Bodner, Simms, Gori report



Entire LCNCA

Leopard Frog and Habitat Status

2013 FROG Report

Wet/Dry Mapping Field Notes

CLF and Fish occurrence
2008, 2009, 2010, 2011, 2013, 2014

Agave Transects

Agave transects for LLNB habitat
2009, 2011

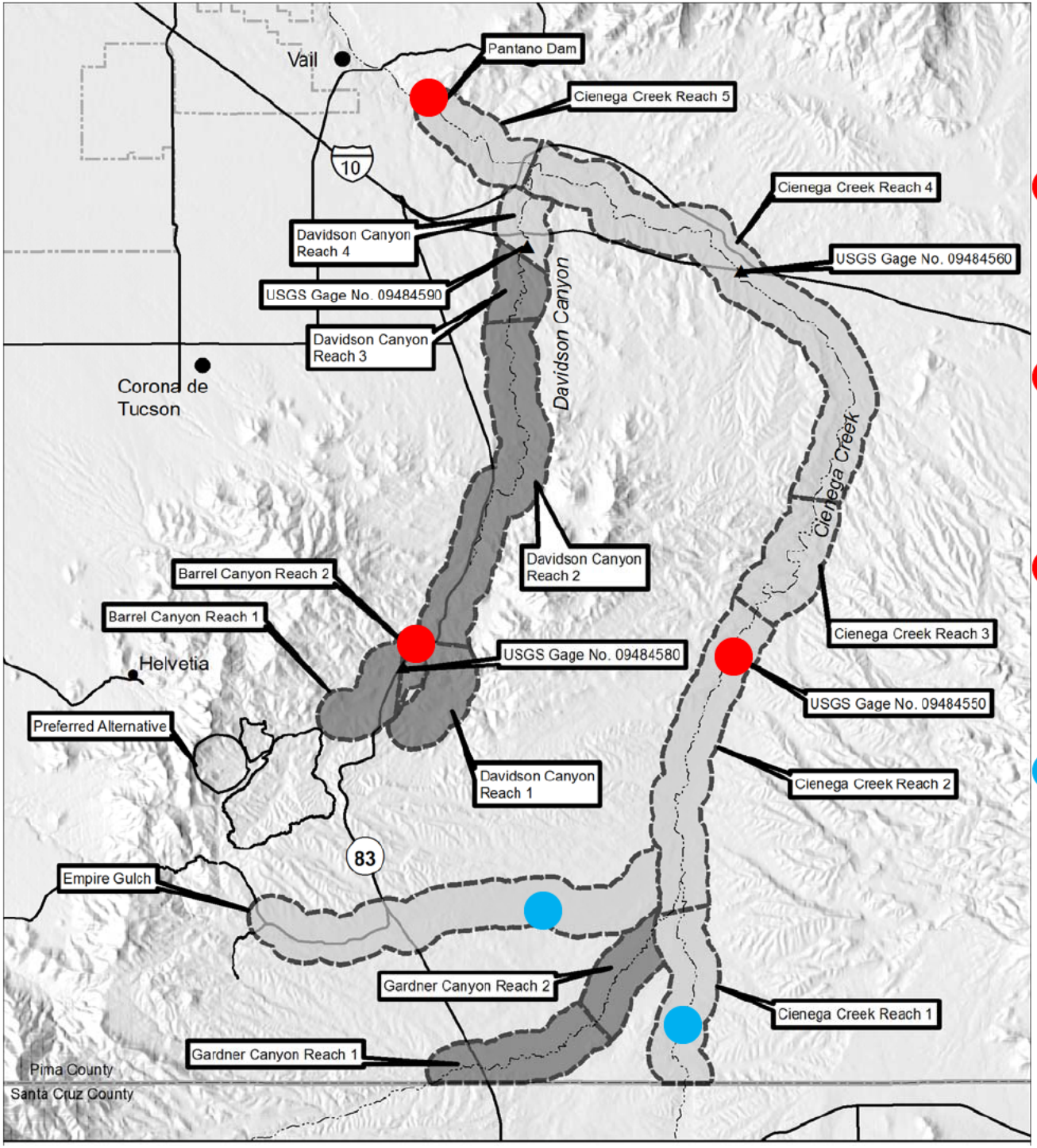
Southwestern Willow Flycatcher

SWFL survey data for 2006, 2008, 2010, 2011, 2012, 2013, 2014

Western Yellow-billed Cuckoo

WYBCU survey data for 2001, 2008, 2009, 2010, 2011, 2014

Summary of Available Information – Hydrologic Framework



Streamflow Data

USGS Streamgages

Cienega Ck near Sonoita (09484550)
2001-present – daily average flow
1993-2001 – paper charts

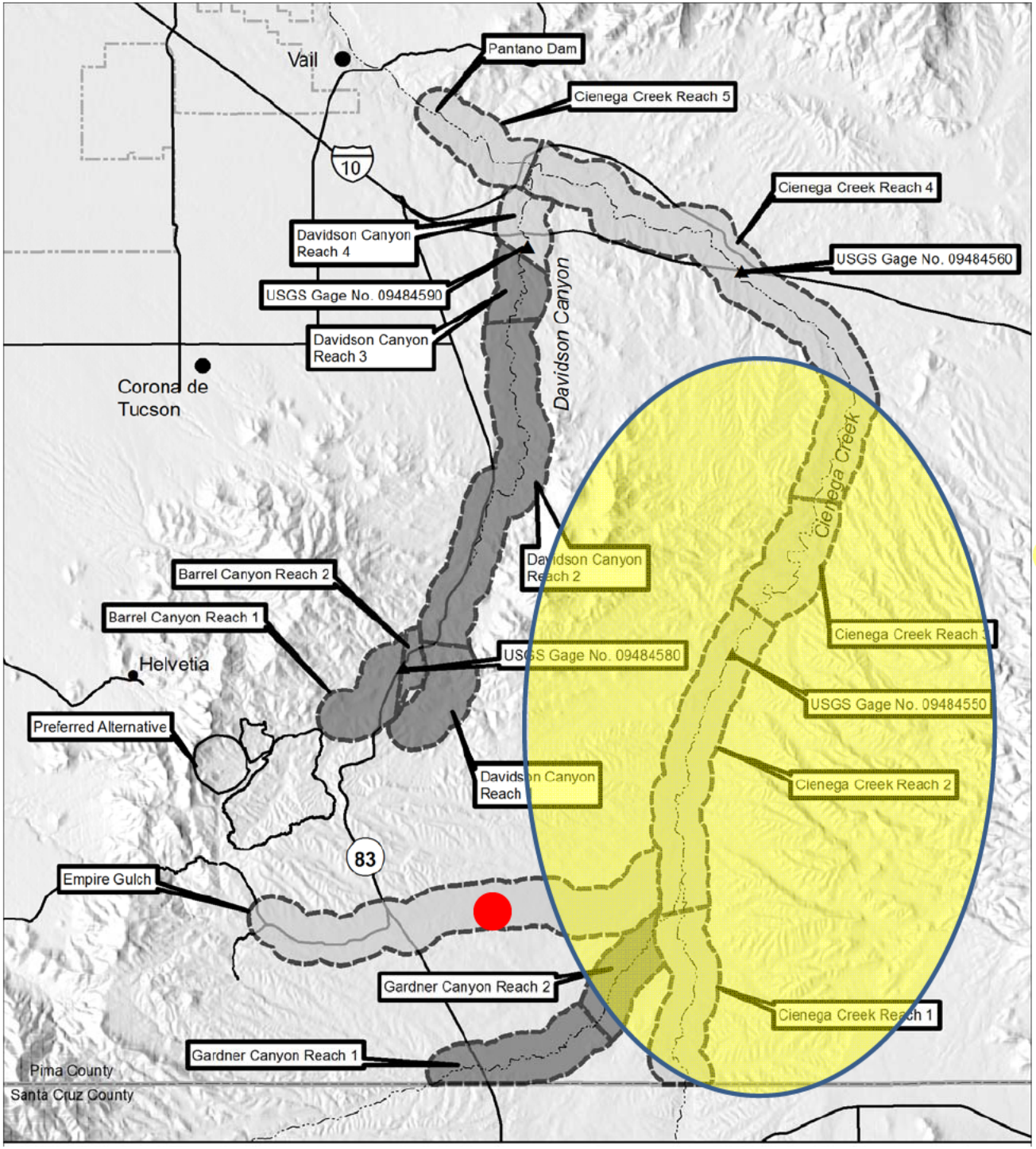
Cienega Ck near Pantano (09484560)
1968-1975 – daily average flow

Pantano Wash near Vail (09484600)
2007-present – daily average flow

Barrel Cyn near Sonoita (09484580)
2009-present – daily average flow

BLM Manual Flow Measurements

Empire Gulch – 2007 – present
Cienega Creek – 2006 – present



Isotope Data

Rosemont Isotope Data

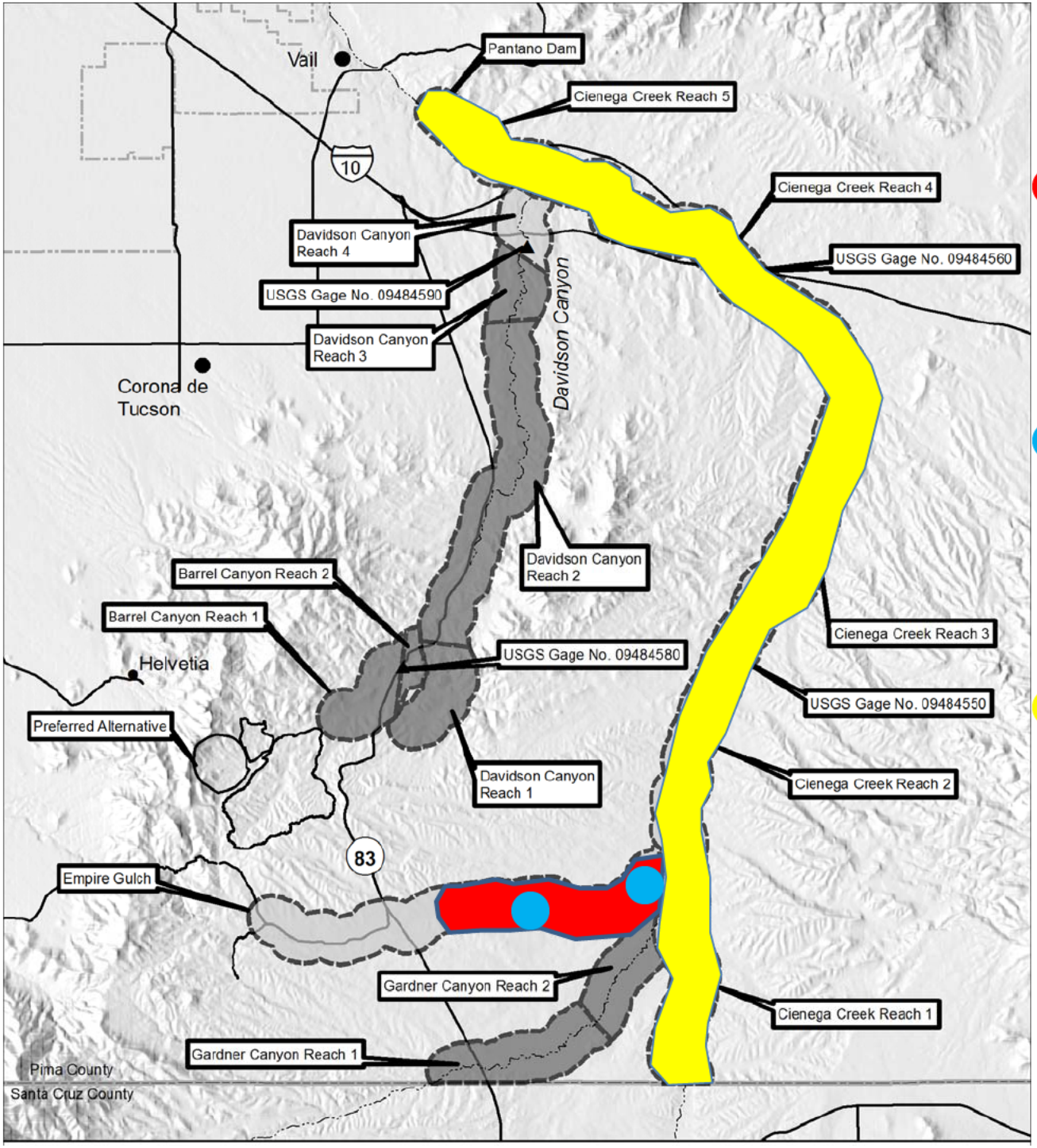
Empire Gulch Springs
Most major springs in area (~20)
Rosemont wells (~30)

Includes oxygen, hydrogen, carbon

Desert Botanical Garden Isotopes

Specific locations not identified but includes surface water samples and cienega water samples

Raw data not supplied, but plot is directly comparable to Rosemont data



Channel Characteristics

Empire Gulch Habitat Survey

17 observations along Empire Gulch
Exact locations not identified
Includes depth, width measurements
June 2014

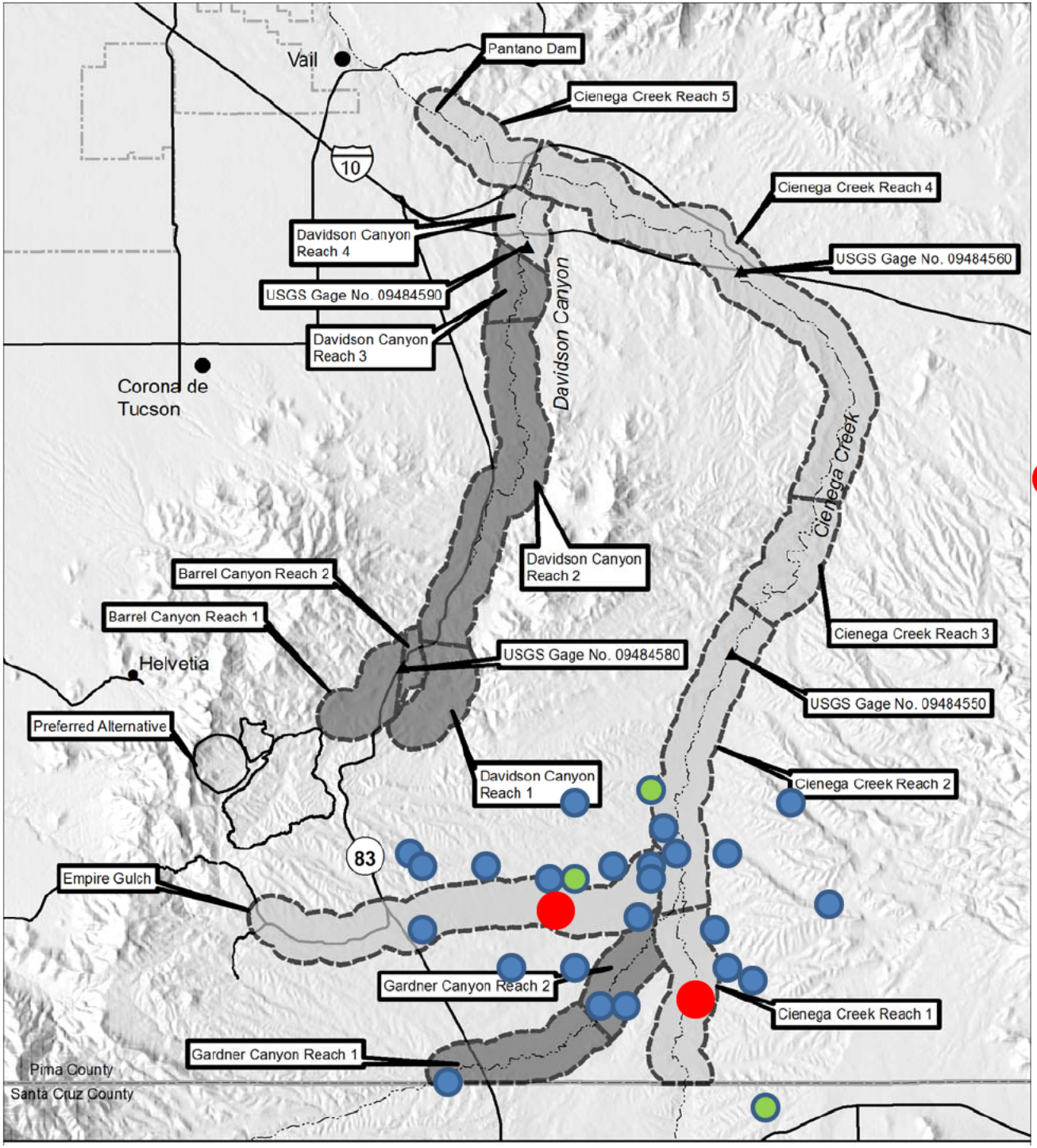
WestLand Cross-Sections

3 cross-sections

Cienega Creek Elevation Points

Series of elevation points along Cienega Creek—unsure of original purpose of measurements. No cross sections

Other BLM Habitat Survey Locations?



Well Logs/Water Levels

BLM Water Level Database

Over 50 wells, throughout LCNCA
Primarily water levels

BLM Piezometers

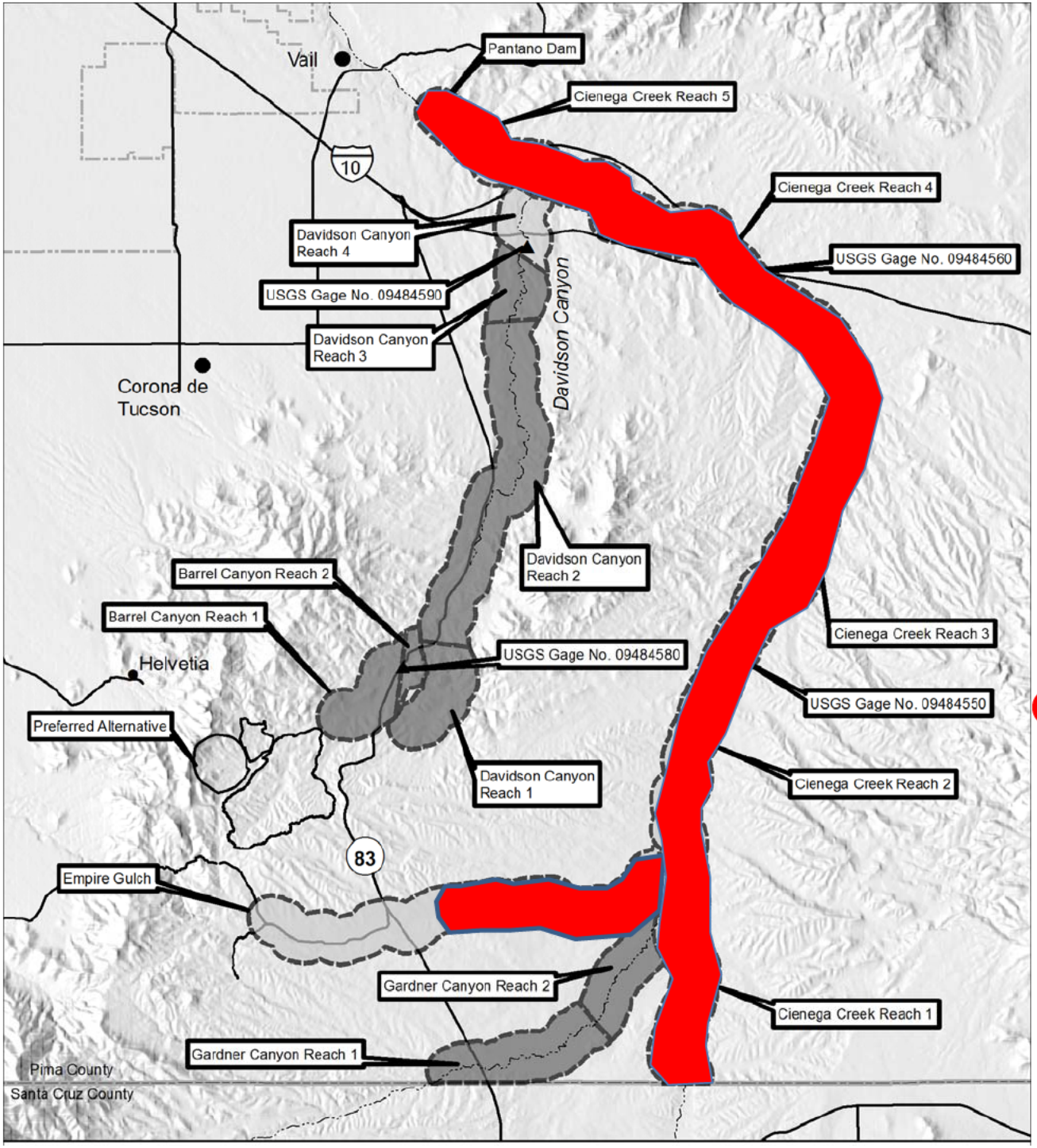
Series of piezometers, not all monitored
Two key ones shown, with continuous water level measurements coincident with streamflow monitoring

Anamax Files

2 Production Wells
14 Test Wells
Logs, Pump Tests

G&M 1970

3 Test Wells (including Test Well #2)
Logs, Pump Tests, Chemistry



Other Basin Information

LCNCA Water Use

2005 Haney Report

Precipitation

Wide variety of precipitation data

Wet/Dry Mapping

2006 – 2014, Late May/Early June

Actionable Predictive Approaches

Complete and ready to go

- Original FEIS analysis (based on 1:1 depth change)
- Refined FEIS analysis (based on empirical flow/depth change)
- Refined FEIS analysis (based on modeled flow change)
- WestLand Wet/dry probabilistic
- Hydro-Logic Upper Empire interpretation
- WestLand and Pima County depth/flow correlations

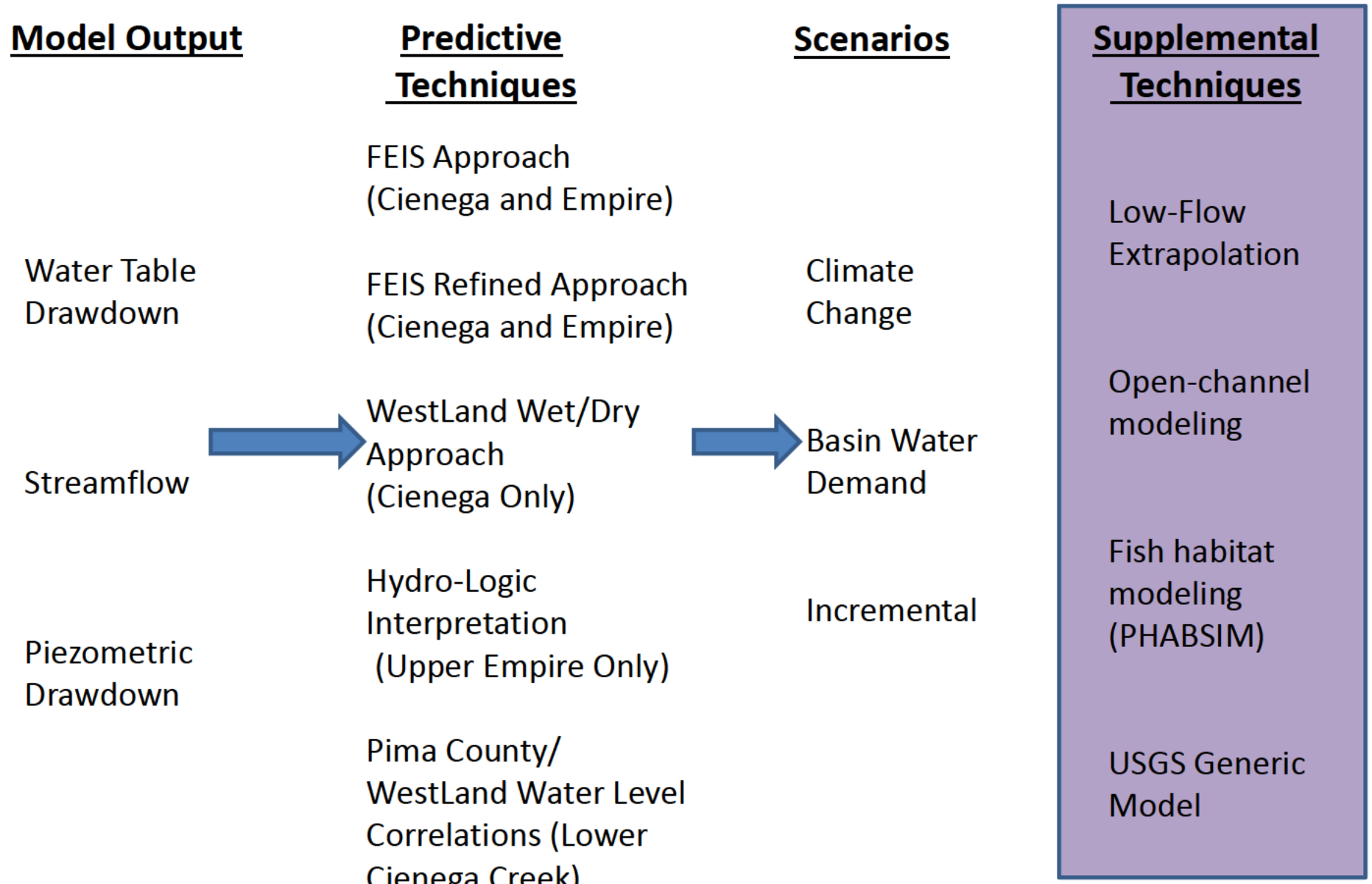
Would require more work

- Open channel modeling
- USGS generic modeling
- EPA risk analysis approach
- % capture zone
- 3- to 7-day low flow analysis
- Fish habitat modeling

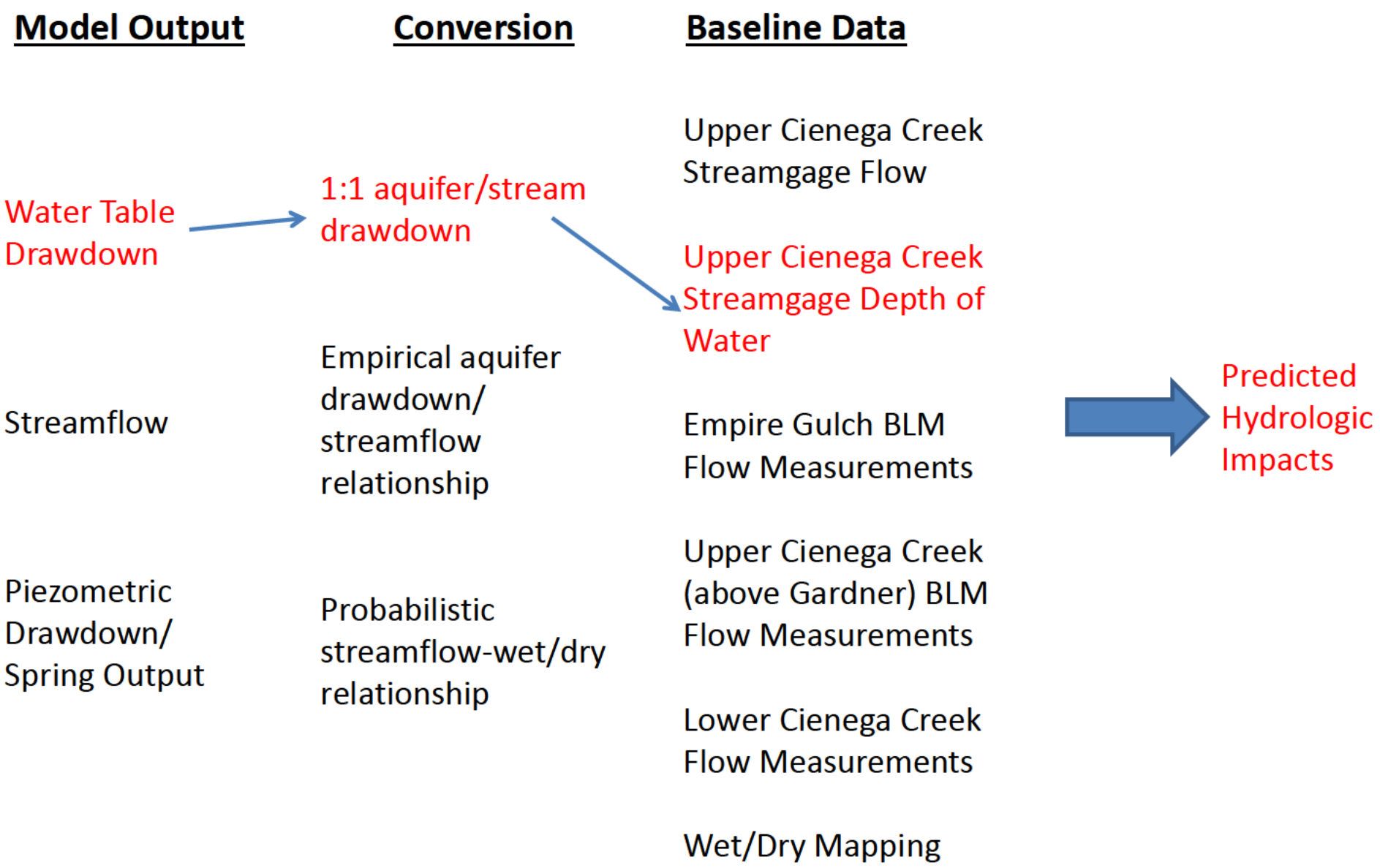
Other concepts

- Climate change
- Basin water demand
- Incremental analysis

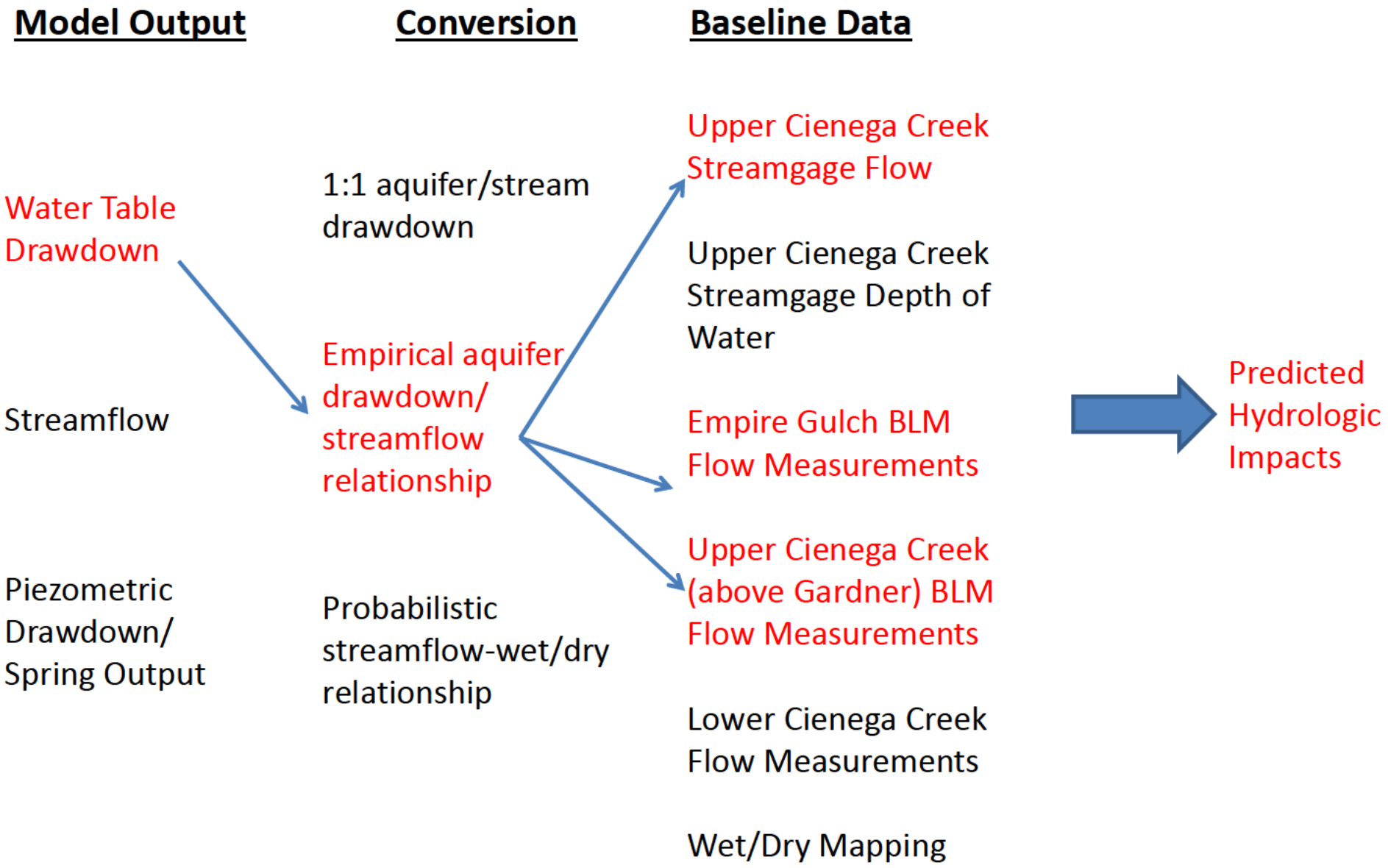
Proposed Approaches



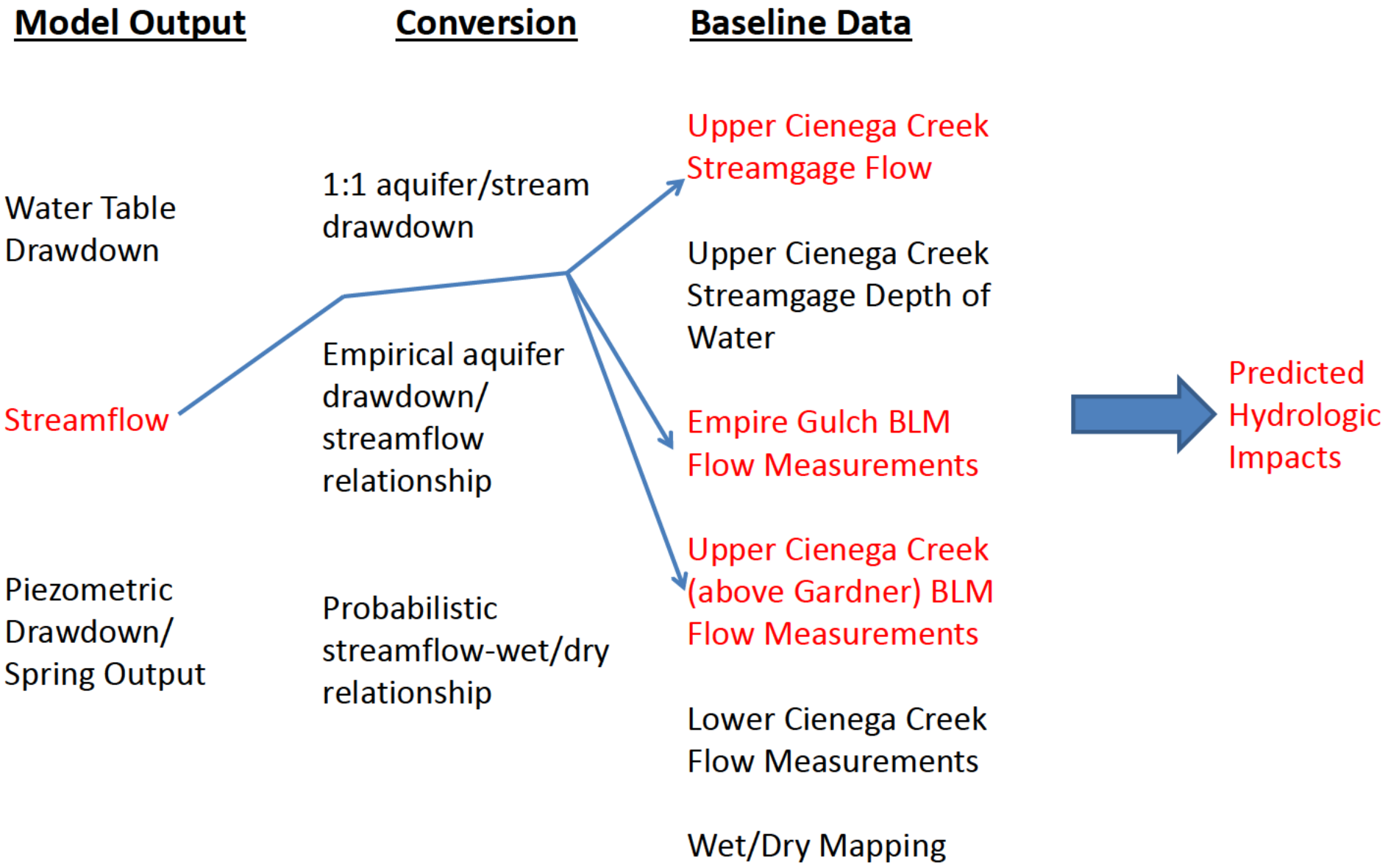
Original FEIS Approach



Refined FEIS Approach (#1)



Refined FEIS Approach (#2)

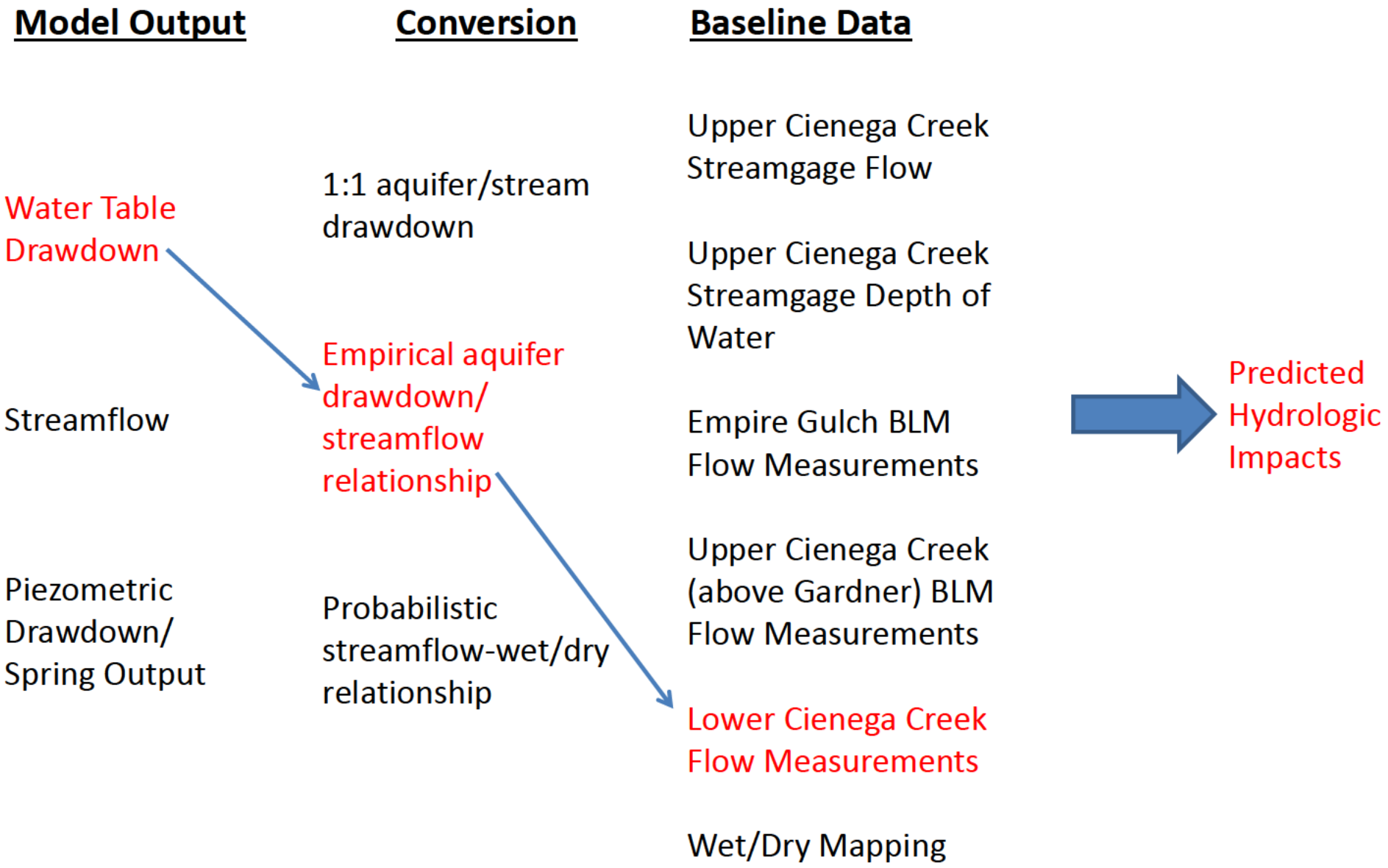


Hydro-Logic Interpretation

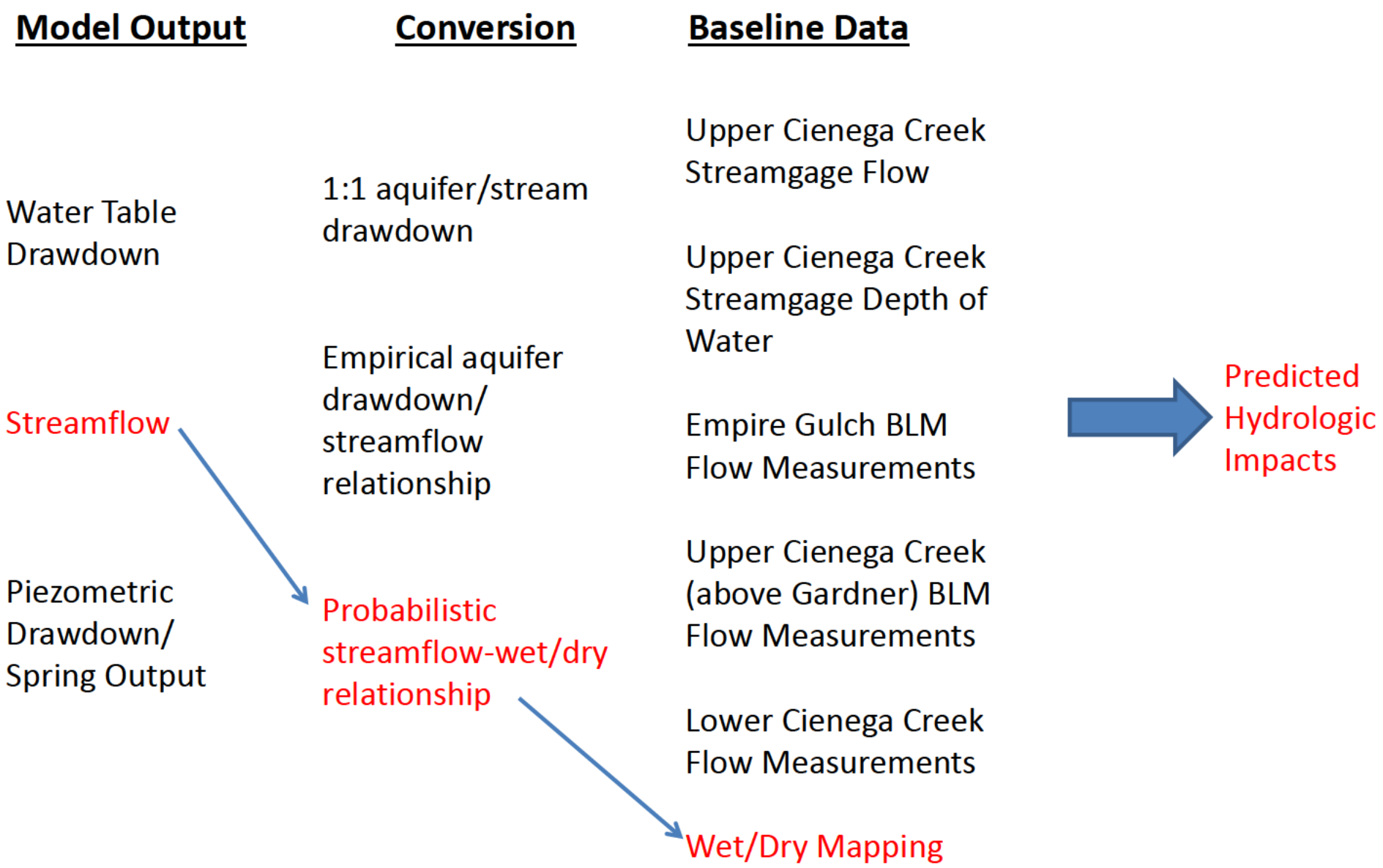
Model Output	Conversion	Baseline Data
Water Table Drawdown	1:1 aquifer/stream drawdown	Upper Cienega Creek Streamgage Flow
		Upper Cienega Creek Streamgage Depth of Water
Streamflow	Empirical aquifer drawdown/ streamflow relationship	Empire Gulch BLM Flow Measurements
Piezometric Drawdown/ Spring Output	Probabilistic streamflow-wet/dry relationship	Upper Cienega Creek (above Gardner) BLM Flow Measurements
		Lower Cienega Creek Flow Measurements
		Wet/Dry Mapping

Predicted Hydrologic Impacts

Lower Cienega Creek Correlations



WestLand Wet/Dry Probabilistic



Supplemental – Low Flow Analysis

Model Output	Conversion	Baseline Data
Water Table Drawdown	1:1 aquifer/stream drawdown	Upper Cienega Creek Streamgage Flow
		Upper Cienega Creek Streamgage Depth of Water
Streamflow	Empirical aquifer drawdown/ streamflow relationship	Empire Gulch BLM Flow Measurements
		Upper Cienega Creek (above Gardner) BLM Flow Measurements
Piezometric Drawdown/ Spring Output	Probabilistic streamflow-wet/dry relationship	Lower Cienega Creek Flow Measurements
		Wet/Dry Mapping

Predicted Hydrologic Impacts

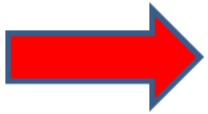
Supplemental – USGS Generic Model

Model Output	Conversion	Baseline Data
Water Table Drawdown	1:1 aquifer/stream drawdown	Upper Cienega Creek Streamgage Flow
		Upper Cienega Creek Streamgage Depth of Water
Streamflow	Empirical aquifer drawdown/ streamflow relationship	Empire Gulch BLM Flow Measurements
Piezometric Drawdown/ Spring Output	Probabilistic streamflow-wet/dry relationship	Upper Cienega Creek (above Gardner) BLM Flow Measurements
		Lower Cienega Creek Flow Measurements
		Wet/Dry Mapping

Predicted Hydrologic Impacts

Supplemental – Open-Channel/PHABSIM

Model Output	Conversion	Baseline Data
Water Table Drawdown	1:1 aquifer/stream drawdown	Upper Cienega Creek Streamgage Flow
Streamflow	Empirical aquifer drawdown/ streamflow relationship	Upper Cienega Creek Streamgage Depth of Water
Piezometric Drawdown/ Spring Output	Probabilistic streamflow-wet/dry relationship	Empire Gulch BLM Flow Measurements
		Upper Cienega Creek (above Gardner) BLM Flow Measurements
		Lower Cienega Creek Flow Measurements
		Wet/Dry Mapping



Predicted Hydrologic Impacts

EPA Risk Analysis Approach

A Place to Start - Chris' Opinions

- We can use these analyses with no further work*. They are not mutually exclusive, and the uncertainty can be defined.

Approach	Locations	Parameter
Refined FEIS Analysis	EG, UCC, UCC above Gardener	Flow/No Flow Extremely low flow
Wet/Dry Probability	UCC	Presence/absence of water
WestLand/PC correlations	LCC	Flow/No Flow Extremely low flow

*Does not preclude peer review to better understand:

- Where are these applicable?
- Are there other refinements that can be made?
- What is the uncertainty?

A Place to Start - Chris' Opinions

- These analyses aren't worth pursuing.

Approach	Why?	Parameter
Open Channel Modeling	Flows are just too low. Edge effects are overwhelming	Depth, width, velocity
Fish Habitat Modeling	Same, plus likely we don't have adequate habitat response data for specific fish species **in the right range of flows**	Depth, width, velocity, habitat suitability for specific species
USGS Generic Model	This provides a theoretical discharge/drawdown relationship, but the empirical correlation does the same thing with less uncertainty.	Supporting work only for FEIS approach

A Place to Start - Chris' Opinions

- These approaches deserve discussion:

Approach	Why might it be useful?	Concerns
Low Flow Analysis	Would extend the limited streamflow record on UCC above Gardner and on Empire Gulch	Statistical manipulation of real-world dataset could weaken predictions
% Capture Zone	A possible approach independent of groundwater modeling?	Requires a steady-state condition, and this hydrologic system would be significantly and dynamically altered by mine
Hydro-Logic Interpretation	An alternative hypothesis that could provide a range of effects	Is it valid? If included, would be one of a range of possibilities, not the sole possibility.

Rosemont Copper Project
Federal Agency Hydrology/Biology Meeting

July 23, 2014, 9:00 a.m. – 5:00 p.m. PST
National Advanced Fire and Research Institute (NAFRI)
3265 East Universal Way, Tucson AZ

Dial-in Instructions:

Video participants dial: 1(b) (6)

Phone participants dial: (b) (6)

Purpose of Meeting:

In May 2014, the Coronado National Forest indicated that it would be reinitiating Section 7 consultation on the Rosemont Copper project. A larger working group met on June 10-11, 2014 to discuss new information and possible analysis approaches that could be used for the Supplemental Biological Assessment. On June 13, 2014, the Coronado sent out a request to participating agencies for specific information. Much of this information has now been provided to the FS and shared with this group at *h*(b) (6) .

The purpose of this meeting is to discuss the new information provided, as well as to discuss a series of possible approaches for predicting future impacts to the aquatic and riparian habitat along Empire Gulch and Cienega Creek. A goal of the meeting will be to develop the list of approaches that are appropriate to use in the Supplemental Biological Assessment.

Agenda:

9:00 – 9:30	Welcome Introductions	Jim Upchurch
9:30 – 11:00	Overview of Available Information Overview of Available Predictive Approaches	Chris Garrett
11:00 – 12:00	Open Discussion of Predictive Approaches	ALL
12:00 – 1:00	Lunch	
1:00 – 3:30	Continuation of Open Discussion of Predictive Approaches	ALL
3:30 – 4:00	Wrap-up, Discussion of Next Steps	Mindy Vogel

List of Attendees:

BLM: Tim Shannon, Dan Moore, Jeff Simms, Mark D'Aversa, Ben Lomeli

EPA: Rob Leidy, Carter Jessop

USGS: Jesse Dickinson, Nick Paretti, Don Pool

USFWS: Jean Calhoun, Jason Douglas

FS: Jim Upchurch, Jennifer Ruyle, Mindy Vogel, Marc Stamer, Salek Shafiqullah

SWCA: Chris Garrett, Melissa Polm, Angela Barclay

Discussion Points / Conclusions:

Prior to the meeting, nine briefing papers were distributed to the group describing possible predictive approaches raised during the meeting on June 10-11, 2014. In addition, a summary of the available information posted by participants since the June 10-11 meeting was provided.

The available information received was summarized and discussed during a presentation led by Chris Garrett. The nine available predictive approaches were also summarized and discussed. The results of this discussion are summarized as follows (note: this is a summary of discussion, no decisions have been made and any approach may be revisited if determined necessary):

Approach	Pros	Cons	Recommendation
Original FEIS Approach (convert modeled drawdown to reduced streamflow using 1:1 linear relationship)	Can be used to describe seasonality Can be used to cross-check predicted streamflow changes May be particularly applicable in marshy areas with standing water Can be applied to both Empire Gulch and Cienega Creek	1:1 linear relationship may not be valid in some hydrologic settings	This approach can be used to cross-check the primary approach. This approach also will allow the full range of impacts (all models, entire range of sensitivity analyses)
Revised FEIS #1 (convert modeled drawdown to reduced streamflow using empirical relationship)	Can be used to describe seasonality Can be used to cross-check predicted streamflow changes	No probabilities involved, but could use peer review to assess reliability or applicability to specific reaches	This approach can be used to cross-check the primary approach. This approach also will allow the full range of impacts (all models,

	Can be applied to both Empire Gulch and Cienega Creek		entire range of sensitivity analyses)
Revised FEIS #2 (use modeled streamflow reductions directly)	Can be used to describe seasonality Can be used to cross-check predicted streamflow changes Can be applied to both Empire Gulch and Cienega Creek	Needs review to assess statistics of correlation	**This is going to be the primary approach—using modeled reduction in streamflow and applying it to existing flow data to predict future flow conditions.**
Lower Cienega Correlations by Pima County and WestLand (covert modeled drawdown to reduced wetted length or streamflow using empirical relationship)	Can be used to cross-check predicted streamflow changes	Needs review to assess statistics of correlation	This approach can be used to cross-check the primary approach. This approach also will allow the full range of impacts (all models, entire range of sensitivity analyses)
Hydro-Logic Interpretation of Upper Empire Gulch springs (affected		Needs peer review, and eventually request for clarification and conversions	This approach requires further analysis to determine whether direct comparison of Empire Gulch Springs to the piezometric head in Test Well No. 2 is reasonable.
WestLand wet/dry probability assessment	Allows look at presence of water instead of presence of flow Statistics allow analysis of “reasonable certainty”	Not applicable reach-by-reach Only applies to Upper Cienega	At this time, this approach does not appear to be useful, both from limited data points (n=8) and from inability to apply reach-by-reach. Could be revisited later for refinement.

EPA Risk Analysis Approach	It wouldn't increase accuracy of any piece of evidence, but would weight relative strength of evidence. Allows for a systematic way to include multiple opinions and multiple lines of evidence	Current process has already accomplished much of what was envisioned by bringing together local expertise and identifying all information available. Long time frame envisioned (6 months).	The approach as presented is fairly generic, and we need more details/examples of how it would be implemented in this specific situation. However, the overall premise may have a role in the process.
Open Channel Modeling	Would allow for a link between reductions in streamflow and characteristics important to fish (depth, width, velocity of flow)	Major outstanding questions: Can the math reflect reality given the overwhelming edge effects? Could you verify with measurements? How fine of a scale could you model? Could it be sensitive for such small measurements? Do species thresholds go down to such small measurements?	At this time, this approach seems to be difficult to implement. However, this approach may have a possible role, depending on the characteristics determined to be important by the biological working group. Needs further investigation.
Fish habitat modeling	Would allow for a link between reductions in streamflow and characteristics important to fish (depth, width, velocity of flow) as well as response by fish species to these variables	Since this modeling is built on open channel modeling, same issues as above	At this time, this approach seems to be difficult to implement. However, this approach may have a possible role, depending on the characteristics determined to be important by the biological working group. Needs further investigation.
Low Flow Analysis	Low Flow analysis is intended to extend	It relies on extrapolation of other	Based on USGS input, seems unlikely to be

	flow records to locations where none exist. This is the case throughout much of the Cienega Creek basin.	existing flow records, but only is feasible if channel and basin properties are similar. It likely wouldn't work very well, as the physical properties near the USGS gauge wouldn't correlate well elsewhere on Cienega Creek or Empire Gulch. May also be undesirable to "doctor" the existing flow records. Using actual flow records for a shorter period may be more defensible.	useful for generating extended base flow data.
USGS Generic Model	Allows a separate theoretical look at the conversion between drawdown and flow	Does not improve accuracy. The results would still be built on top of the existing model. Empirical data now available likely trumps this approach.	Could be applied, but not likely to be an improvement over Refined FEIS Approach #1 for establishing correlation between drawdown and streamflow.

Action Items:

The following information was identified as likely available and important for consideration in the analysis. Please have the following information posted to the client server site (*https://client.swca.com/RosemontGWMD*) by **August 8th**.

BLM: Critical cross-section locations, additional HOBO data, Desert Botanical Garden isotope raw data, additional wet/dry data, Mattie Canyon wet/dry and stream flow data, Piezometer datalogger data, Jeff's maps from field trip, Identification of which wells are pumped.

EPA: Rob Leidy field notes, Risk analysis example (different from Pebble Mine)

USGS: Chris Menges dissertation, 2004 site data

FS / SWCA: Nature Conservancy Habitat reports '04 & '08,

Additionally, the **FS** will take lead and establish and coordinate a federal biological information group (FBIG) to look at: Description of riparian thresholds, Habitat characterization of reaches, and framework/methodology to link changes in hydrology to changes in habitat. Agencies offered names of people determined best fit to participate in this group.

Following additional group discussions, review, and determining the reaches of interest, the **FS** will request report clarifications from Grady (gpm & inconsistencies).

From: Bieler, Tracy A -FS on behalf of FS-Video Conference Service Desk
To: Jessop, Carter
Subject: RE: VTC setup
Date: Tuesday, July 22, 2014 5:31:41 AM
Attachments: image004.png

Carter,

If you have a few minutes to test today, please let us know, I would just like to verify that the connection works with the new sip address. I am in this morning and you can contact me at 406 466 5198 or you can contact the helpdesk at 503 808 2152.

Thanks,
Tracy

Tracy Bieler
Acting Executive Officer/Video Support Project Leader
Digital Visions Enterprise Team

ph: 406-466-5198
tbieler@fs.fed.us
www.fs.fed.us/enterprise

Video Service Desk
503-808-2152
Click here to visit the Video Conferencing Service Desk

Caring for the land and serving people

From: Jessop, Carter [mailto:JESSOP.CARTER@EPA.GOV]
Sent: Monday, July 21, 2014 6:40 PM
To: FS-Video Conference Service Desk
Cc: mpolm@swca.com
Subject: RE: VTC setup

Hello Bess,
I apologize for the delay in following up with you. We will be using the same equipment as the previous conference, but at a different location and therefore a different SIP. The SIP for the machine we will be using is (b) (6) Please let me know if I can provide you any further information to help get this going. This VTC machine is about 100 feet from my cubicle so if there is a need to test it tomorrow, I would be more than happy to do so.

Thanks.

-Carter

Carter W. Jessop
U.S. EPA, Region 9
Environmental Review Section (ENF-4-2)
75 Hawthorne Street
San Francisco, CA 94105
(415) 972-3815
jessop.carter@epa.gov

From: Thompson, Elizabeth M -FS [mailto:emthompson02@fs.fed.us] **On Behalf Of** FS-Video Conference Service Desk
Sent: Wednesday, July 09, 2014 3:26 PM
To: Jessop, Carter
Cc: mpolm@swca.com
Subject: RE: VTC setup

Hi Carter,

I have been asked to contact you on behalf of Melissa Polm. She has requested a video conference connection to the EPA for a meeting scheduled on July 23. If you would like to join this video conference, can you please provide the details of how we should connect to you? Will you be using the same equipment that was used for the June 11 call, and should we plan to connect using the same method (SIP) and number? I have also left a message with Steven Jong to contact us at 503.808.2152.

Thank you,
Bess

Bess Thompson
Video Support
Digital Visions Enterprise Unit

Video Service Desk
(503) 808-2152
Click here to visit the Video Conferencing Service Desk

Click here to open the video bridge reservation form

A Forest Service Enterprise Team http://www.fs.fed.us/digitalvisions

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From: Melissa Polm [mailto:mpolm@swca.com]
Sent: Wednesday, July 09, 2014 4:03 PM
To: FS-Video Conference Service Desk
Subject: RE: VTC setup

I assume they will be on the same equipment and I don't have technical contact. If you need to contact them, try Carter Jessup at the email address on my form. Sorry and thanks!

Melissa Polm
Planner/ Asst. Project Manager
Rosemont Copper Project

From: Thompson, Elizabeth M -FS [mailto:emthompson02@fs.fed.us] **On Behalf Of** FS-Video Conference Service Desk
Sent: Wednesday, July 09, 2014 12:52 PM
To: Melissa Polm
Subject: RE: VTC setup

Will the EPA be using the same system as for past calls, or do you have a technical contact that we should call to

arrange a connection?

Thanks,
Bess

Bess Thompson
Video Support
Digital Visions Enterprise Unit

Video Service Desk
(503) 808-2152
Click here to visit the Video Conferencing Service Desk

Click here to open the video bridge reservation form

A Forest Service Enterprise Team http://www.fs.fed.us/digitalvisions

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From: Melissa Polm [mailto:mpolm@swca.com]
Sent: Wednesday, July 09, 2014 1:34 PM
To: FS-Video Conference Service Desk
Subject: RE: VTC setup

7/23/14- I thought I put it on the form- sorry!

Melissa Polm
Planner/ Asst. Project Manager
Rosemont Copper Project

From: Bowles, Robert J -FS [mailto:robertbowles@fs.fed.us] **On Behalf Of** FS-Video Conference Service Desk
Sent: Wednesday, July 09, 2014 12:13 PM
To: Melissa Polm
Subject: RE: VTC setup

Hello, I left a voicemail on the phone number provided on the form. Can you please check the date and let us know when the meeting will be held.

Thanks,
Rob

From: Melissa Polm [mailto:mpolm@swca.com]
Sent: Wednesday, July 09, 2014 12:42 PM
To: FS-Video Conference Service Desk; Bieler, Tracy A -FS; Holley, Teresa J -FS
Cc: Vogel, Mindy S -FS
Subject: VTC setup

All-
My Forest Service email is still getting setup, so I have to use this one, but I need to submit the VTC Bridge form for a meeting in 2 weeks. Please send me back the call in number for people to join via phone, just in case. The location for VTC at NAFRI is tentative, but I will update you once it is confirmed. Also, we have been able to

hook in with the EPA VTC equipment at least twice before, so there shouldn't be an issue.

Thanks a bunch!!

Melissa Polm
Planner/ Asst. Project Manager
Rosemont Copper Project

Visit Our Website: http://www.swca.com


USDA


FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

From: Ruyle, Jennifer -FS
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; Stamer, Marc -FS; cgarrett@swca.com; mpolm@swca.com; (b) (6) [redacted]; abarclay@swca.com; Calhoun, Jean; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Kathy Arnold; blindenlaub@westlandresources.com; David Cerasale; Joyce M. Francis; Raul Vega; JWindes@azgfd.gov; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; julia.fonseca@pima.gov; brian.powell@pima.gov; Jesse Dickinson (jdickins@usgs.gov); saleake@usgs.gov
Subject: Rosemont Copper Project Hydrology Workshop
Date: Friday, June 13, 2014 5:27:02 PM
Attachments: Hydrology Working Group Info request 061214.docx

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Thanks to all of you who participated in our meetings on Tuesday and Wednesday. Attached is a list of the information that was discussed in our meeting that the Forest would like to be gathered and submitted by the listed party. Please upload all of the information directly to the SWCA Client folder as previously instructed. We would like all information provided by EOD June 27th. Once you have uploaded the requested information, please send an email to Melissa Polm (mpolm@swca) and Mindy Vogel (msvogel@fs.fed.us) so we can be sure that we are able to retrieve it. If you have any questions or issues with the information requested, please be sure to let us know.

Collecting all the information will take some time, and we do not foresee having anything additional to discuss for the tentative date set on the 18th. We will let you know when or if we need to have a follow-up meeting or call. Thanks again to you all for such a productive meeting. We truly appreciate the time, energy and thought that you all put forward.

Jennifer M. Ruyle
Natural Resources and Planning Staff Officer
Coronado National Forest
300 W. Congress
Tucson, AZ 85701
jruyle@fs.fed.us
O: 520.388.8351
C: (b) (6) [redacted]

New Information Discussed in Working Group to be Provided to the Forest for Dissemination:

Agency/Entity to Provide Info	New Information Mentioned to be Brought Forward
Rosemont/Grady O'Brien	Isolated model run on Empire Gulch perennial areas that will provide modeled reductions in streamflow, similar to modeled reductions provided for Cienega Creek
Rosemont/Westland	Provide existing isotope/Geochem/age-dating data for Empire Gulch Conduct field measurements of depths and channel geometry for Empire Gulch Probability approach (like that presented), looking at 25% reduction in wetted stream length
BLM	New information to be collected: Identification of important areas for cross-section Provide preliminary data from wet/dry mapping 2014 Information about created refugia for listed species (pond in Empire Gulch, wetlands near confluence with Cienega Creek
BLM	Existing info to newly provide: Data/Understanding of Desert pupfish. Information needs regarding reintroductions (for this and other species they have recently reintroduced): locations, dates, and any knowledge of current status of those populations Location of piezometers (WP-9) Isotope/Geochem data from Desert Botanical Garden Shapefile or similar GIS coverage for 88 existing wells Fish survey data Aquatic habitat inventory 2000s Riparian inventory (RACE 1989) Riparian cross-sections Dr. Rosen continuous temp data 2011-present Dr. Rosen CLF population data Simms tadpole/predator data 2004-present Topminnow data 2001-present CLF surveys 1995-present Wet/dry mapping procedures Anamax files pertinent information
USGS	Provide Stan's modeling files for simple stream/aquifer scenario
Pima County	Provide data used for water level/stream length correlation presentation, including PAG data Provide ADEQ longitudinal analysis
Forest Service	Mesh streamflow records on Cienega Creek, if possible Investigate utility of Streamstats

From:	Vogel, Mindy S -FS
To:	Ruyle, Jennifer -FS; Upchurch, Jim -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; nparetti@usgs.gov; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov); msdaversa@blm.gov; blomeli@blm.gov; nparetti@usgs.gov; drpool@usgs.gov; Jesse Dickinson (jdickins@usgs.gov)
Subject:	Rosemont Project federal hydro/bio working group
Date:	Wednesday, August 06, 2014 1:20:48 PM
Attachments:	removed.txt image003.png image004.png

Hi Team.

Things are moving along with the FBIG (i.e. the bio-subgroup) this month. We are hoping to have some information to share along with some updated info on the hydro side too. Therefore, I'd like to propose another meeting with this Federal hydro/bio group to bring the two sub-group discussions together and to discuss our path forward.

Please reserve September 9th (all day) for this meeting. I will send out the meeting details as the date nears – but I thought it best to get it on everyone's calendar now. Please let me know if you are unable to make this date.

Thanks!

CNF_email_sign

From: Vogel, Mindy S -FS
Sent: Wednesday, July 30, 2014 2:26 PM
To: Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; 'abarclay@swca.com'; 'jean_calhoun@fws.gov'; jason_douglas@fws.gov; 'cfsmith@usgs.gov'; 'leenhout@usgs.gov'; 'alcoes@usgs.gov'; 'JESSOP.CARTER@EPA.GOV'; 'Marjorie.E.Blaine@usace.army.mil'; 'Leidy, Robert'; nparetti@usgs.gov; 'Goldmann, Elizabeth'; 'Jeffrey Simms'; 'Moore, Daniel'; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; 'blomeli@blm.gov'; 'cgarrett@swca.com'; 'Melissa Polm (mpolm@swca.com)'; Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov); 'msdaversa@blm.gov'; blomeli@blm.gov; nparetti@usgs.gov; drpool@usgs.gov; Jesse Dickinson (jdickins@usgs.gov)
Subject: RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

Hi Team

Attached are the notes (below the agenda) from last week's meeting in addition to the task with follow-up items. Please note, the last page indicates that we are asking for all the additional information to be posted to the client server by August 8th (many of you are already aware of this date).

If you have any questions or concerns, please contact me.
Thanks!!

CNF_email_sign

From: Vogel, Mindy S -FS
Sent: Friday, July 18, 2014 2:30 PM
To: Ruyle, Jennifer -FS; Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; leenhout@usgs.gov; alcoes@usgs.gov; JESSOP.CARTER@EPA.GOV; Marjorie.E.Blaine@usace.army.mil; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; cgarrett@swca.com; Melissa Polm (mpolm@swca.com); Stamer, Marc -FS; Timothy Shannon (tshannon@blm.gov)
Subject: RE: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

Hi Team.

Attached you will find a number of documents for the upcoming meeting on June 23rd for the federal agency working group on the Rosemont Copper project. The agenda includes the time, location, and dial in instructions. The purpose for the meeting is described in the agenda as well as below in the original email from the FS to this group.

I am also attaching:

(1) a summary of all the data and information reports that were turned in to the FS since the last meeting in June. Hopefully you have already had a chance to review this information as it was posted to the client share site at t[redacted] (b) (6)

(2) Nine (9) briefing papers on different approaches that were presented at the last meeting. These will be discussed briefly by Chris Garrett at the start of the meeting on 7/23.

Please forward this message on only to others in your agency whom I may have missed that will be participating in this meeting.

If you have any questions, please feel free to contact me (info below).
Thanks!!

CNF_email_sign

From: Ruyle, Jennifer -FS
Sent: Friday, June 27, 2014 4:04 PM
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; JESSOP.CARTER@EPA.GOV; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; Ruyle, Jennifer -FS; cgarrett@swca.com; Melissa Polm (mpolm@swca.com)
Cc: Marjorie.E.Blaine@usace.army.mil
Subject: Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting

As part of the follow-up to the hydrology working group meeting on June 10-11, we would like to meet with the sub-set of Federal agency participants on July 23rd, all day. The purpose of the meeting will be to review and discuss selected possible analysis approaches that could be used in the Section 7 process to describe future impacts to aquatic and riparian systems. The specific goal of the meeting will be to discuss the information presented in a series of draft briefing papers prepared by the Forest Service, in order to identify which approaches would decrease uncertainty or increase accuracy compared to existing analysis. Briefing papers will be distributed prior to the meeting to allow adequate time for review. The meeting location is yet to be determined, but we will make sure there is video conferencing capabilities for those unable to attend in person. Please let me know if you are able (or not) to attend. Thanks!

Jennifer Ruyle
Natural Resources and Planning Staff Officer
Forest Service
Coronado National Forest, Supervisor's Office
p: 520-388-8351
c: (b) (6)
f: 520-388-8305
jruyle@fs.fed.us
300 West Congress St.

Tucson, AZ 85750
www.fs.fed.us

Caring for the land and serving people

********** ATTACHMENT REMOVED **********

This message contained an attachment which the administrator has caused to be removed.

********** ATTACHMENT REMOVED **********

Attachment name: [image001.jpg]
Attachment type: [image/jpeg]

From:	Ruyle, Jennifer -FS
To:	Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; abarclay@swca.com; jean_calhoun@fws.gov; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; blomeli@blm.gov; Ruyle, Jennifer -FS; cgarrett@swca.com; Melissa Polm (mpolm@swca.com)
Cc:	Marjorie.E.Blaine@usace.army.mil
Subject:	Save the date, July 23rd, Rosemont Copper Project hydrology working group - Federal agency subgroup meeting
Date:	Friday, June 27, 2014 4:04:28 PM
Attachments:	removed.txt image002.png image003.png

As part of the follow-up to the hydrology working group meeting on June 10-11, we would like to meet with the sub-set of Federal agency participants on July 23rd, all day. The purpose of the meeting will be to review and discuss selected possible analysis approaches that could be used in the Section 7 process to describe future impacts to aquatic and riparian systems. The specific goal of the meeting will be to discuss the information presented in a series of draft briefing papers prepared by the Forest Service, in order to identify which approaches would decrease uncertainty or increase accuracy compared to existing analysis. Briefing papers will be distributed prior to the meeting to allow adequate time for review. The meeting location is yet to be determined, but we will make sure there is video conferencing capabilities for those unable to attend in person. Please let me know if you are able (or not) to attend. Thanks!

USDA USFS

Jennifer Ruyle
Natural Resources and Planning Staff Officer

Forest Service
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Attachment name: [image001.jpg]
Attachment type: [image/jpeg]

From: Ruyle, Jennifer -FS
To: Upchurch, Jim -FS; Kingsbury, Jamie -FS; Shafiqullah, Salek -FS; Stamer, Marc -FS; cgarrett@swca.com; mpolm@swca.com; (b) (6) ; abarclay@swca.com; Calhoun, Jean; jason_douglas@fws.gov; cfsmith@usgs.gov; Vogel, Mindy S -FS; leenhout@usgs.gov; alcoes@usgs.gov; Jessop, Carter; Leidy, Robert; Goldmann, Elizabeth; Jeffrey Simms; Moore, Daniel; Kathy Arnold; blindenlaub@westlandresources.com; David Cerasale; Joyce M. Francis; Raul Vega; JWindes@azgfd.gov; Gurrieri, Joseph T -FS; Congdon, Roger D -FS; julia.fonseca@pima.gov; brian.powell@pima.gov; Jesse Dickinson (jdickins@usgs.gov); saleake@usgs.gov; blomeli@blm.gov; jean_calhoun@fws.gov
Subject: Update: Rosemont Copper Project Hydrology Working Group
Date: Wednesday, July 02, 2014 1:31:19 PM

Hi all –

As you all know, after our face-to-face meeting several weeks ago on June 10-11,the Coronado sent out a request for some of the informational items requested during the meeting, with a requested deadline of June 27.

We know that some information is still forthcoming, but we wanted to make the group aware of those items that have now been delivered and are available in the same access folder.

The following items were delivered by BLM and can be found here: \R(b) (6)

- Anamax files. Contains:
  - Construction details, well log, pumping test, water quality for production well EP-1 (1975)
  - Construction details, well log, elogs, pumping tests for test wells E-1 through E-14 (1974-75)
  - 1975 Harshbarger Groundwater Development Report for Empire Ranch
  - Misc correspondence, handwritten notes, and maps regarding test wells and water supply
- Table describing dates of aquatic species reintroductions
- Misc. data regarding seven T&E species, including CLF, Gila Chub, Gila Topminnow, LLNB, water umbel, SWFL, YBC
- Limited isotope data from Desert Botanical Gardens
- Shapefile showing LCNCA well locations
- 2014 Wet/dry mapping data
- Laney 2005 water use study for LCNCA

The following items were delivered by USGS and can be found here: \RosemontGWMD\Groundwater Models

- Generic groundwater model files to explore GW/SW interactin

The following items were delivered by Rosemont and can be found here: \RosemontGWMD\RCC Information

- Memo from WestLand Resources describing field measurement of cross-sections on Empire

Gulch. Excel file with raw data also posted.

- Memo from HydroLogic (Grady) describing results of modeled Empire Gulch streamflow/spring discharge
- Memo (revised since meeting) describing results of WestLand wet/dry probabilistic approach
- Memo from Rosemont describing results of additional isotope work
- Also, please note that we have also posted the modeling reports delivered in late 2012 as a result of the October 2012 water panel meeting, containing the many steady state analyses and boundary condition analyses that were requested of Rosemont, and were a topic of discussion at the 6/10-11/14 meeting.

The following items were delivered by Pima County and can be found here: \RosemontGWMD\Pima County Information

- Copy of powerpoint from meeting
- August 2013 Powell report on trends on Cienega Creek
- Appendix by Huth (ADEQ) describing data collection efforts on Cienega Creek

The following post-meeting items were posted by SWCA and can be found here: \RosemontGWMD\SWCA Additional Discussion Docs

- Process Paper describing climate change scenario used in NEPA process

We will keep you abreast of any additional documentation posted to the folder—we do not expect to keep the folder active indefinitely, so please be sure to download the data as needed. Thanks for your participation and willingness to provide information.

Jennifer M. Ruyle
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